Vol. 26 MAY, 1905 No. 153

THE FOUNDRY

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CLEVELAND, OHIO.

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Crucible Melting Furnace

has demonstrated its superiority over the old Coke method in its use with Oil, or Natural Gas and Air.

Its "*Success*" is acknowledged by the leading Foundrymen, note the following extracts:

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No. 2. We are tickled to death with the two Steele-Harvey Furnaces, and we regard them as far ahead of the old coke Pit Furnaces as the moon is above the earth.

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BRASS FOUNDRY METALS.

Standard Style

Furnace in Melting Position

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Always ready for immediate use. Continuous melter, *Crucibles not removed in pouring.*

Terms and guarantee

We will install on trial and instruct free of charge. Furnaces contain Nos. 40, 60, 125, and 275 Crucibles.

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MODERN FOUNDRY MACHINERY

SAND MIXER

Not an Experiment

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NOTE. — In order to clearly explain the Modus Operandi of this scientific and practical method of mixing Molding Sand, Facing Sand and Core Sand, we have issued a small pamphlet which will be sent on application.

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THIS giant has arms of iron and muscles of steel. He can do the work of ten men in factory, foundry, shop or warehouse. His other name is

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He makes no fuss; is never in the way and is always ready when wanted, does not wear floors and saves you time, bother and money.

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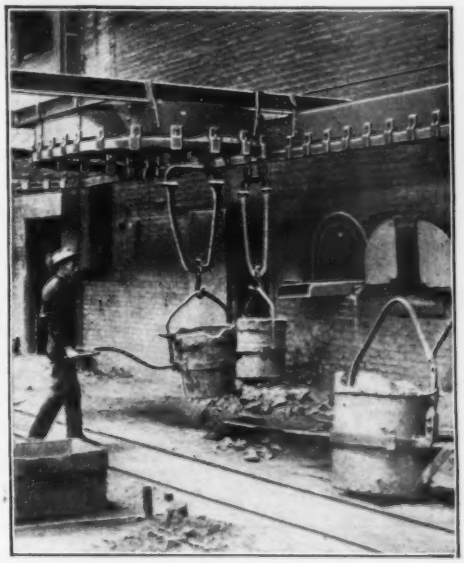
The Coburn Trolley Track Lifting and Carrying Devices are simple, ingenious and effective. With it one man does the work of three or four men and does it easily. If interested, send for our catalogue. Fully illustrated.



The Coburn Trolley Track M'n'f'g Co.

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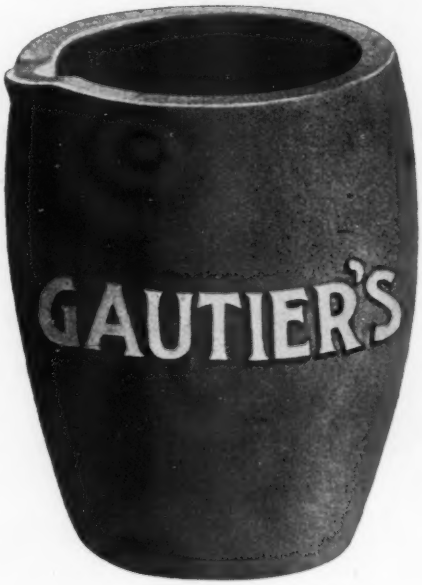
A dependable crucible for all metals



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To use—they cost much less.

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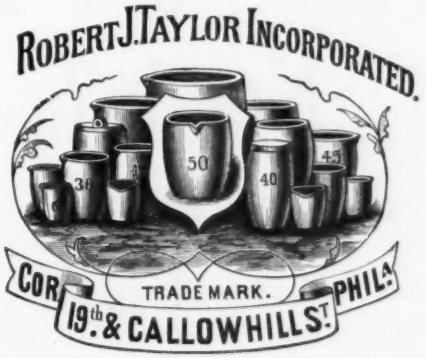

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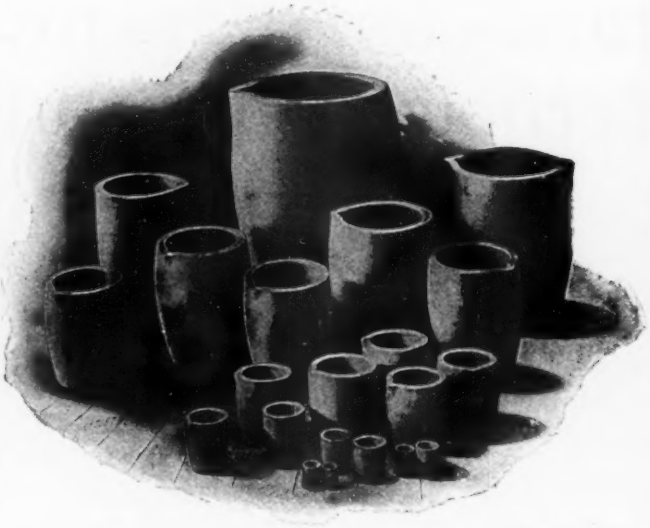

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Crucible-making has engaged our entire thought and labor for 35 years. This partly explains why McCullough-Dalzell Crucibles lead all others.

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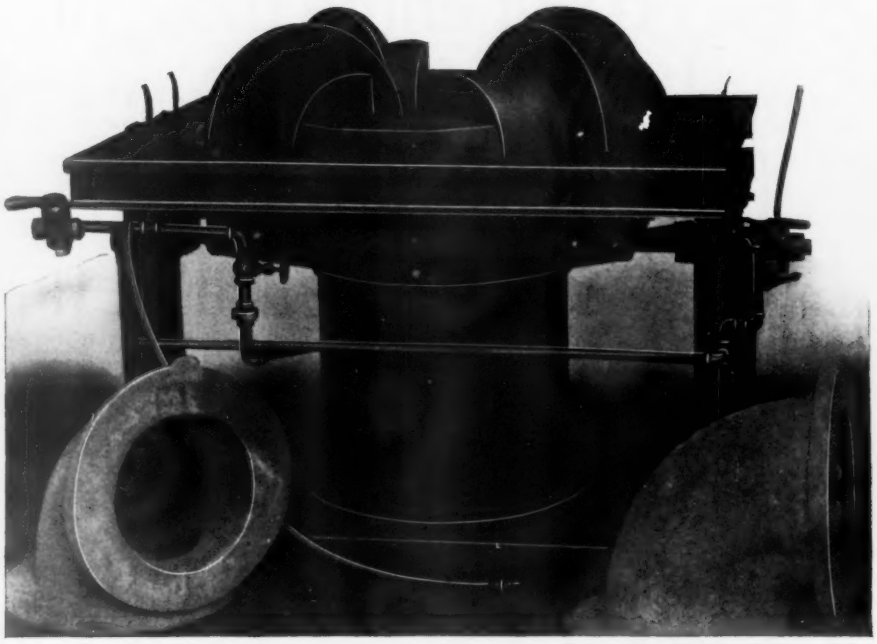

No. 10 Machine fitted with 2-12" flanged Ells. Complete mold made in 20 minutes.

Adapted for large molds, molds that no other power machine can do without the aid of hand rammers. Regular barred up flasks are completely and perfectly rammed, or jarred, up on machine and no hand ramming whatever is done.

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Chaplets constructed on scientific principles.

Made of the best grade of mild steel, which fuses with cast iron or steel more readily than any other material. They can be shaped by the molder to any form. The heads will not come off and being round can more easily be placed in position than square headed chaplets which have sharp corners to damage the mold or core.

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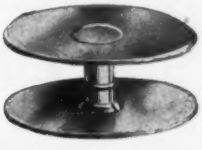

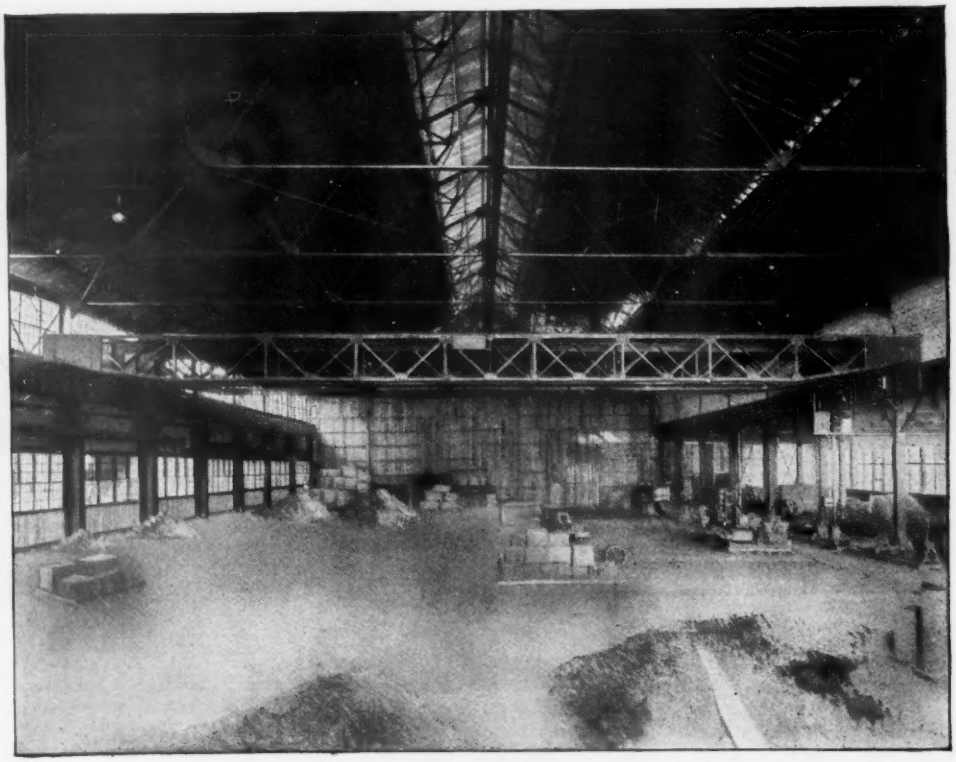

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THE FOUNDRY

Vol. 26, No. 3. *CLEVELAND, OHIO, MAY 1905.* *Whole No 153*

Brass Foundry of the Yale & Towne Mfg. Co., Stamford, Conn.

Like the iron foundry, this department has been very carefully equipped for the production of the special castings required for the line of manufacturing that is carried on by this company. The brass foundry proper is 120 by 129 ft. At one end there are two rooms, each 34 by 78 ft., one of which is used as a core room. The most of the sand for the brass foundry is stored in the shed adjacent to the foundry and the sand mixing department is located in a wing 20 by 24 ft. situated on one side of the building. Great care is taken in the preparation of the sand for the different classes of work, the mixing department being equipped with a magnetic separator for removing any iron from the sand which has been used, and with suitable grinding and sifting machinery for preparing the various facings. The furnaces are situated in the center of the foundry building, being arranged in groups of 16 furnaces each. The pots are drawn from the furnaces and carried to the side floors on suitable trolleys supported from I-beams. They are then taken to the molds with ordinary shanks.

ONE SIDE OF BRASS FOUNDRY.

Practically all the work is bench molding, each man being equipped with a bench, the necessary number of flasks and bottom boards and the required amount of sand. In most cases perforated iron plates are used as bottom boards. As the men prefer to ram their flasks with their feet, a rope is suspended over

CLEANING DEPARTMENT.

each tub to assist the man in jumping up on to the mold and as a support while using his feet for ramming. The flasks are very carefully designed to receive the work being done. For all the more delicate work the molds are skin dried by placing them around stoves which are situated in the center of the building near the melting furnaces. The molds are smoked by placing them upon suitable racks and passing a pot of burning resin under them. The fine carbon from the resin smoke serves as a blacking or facing.

The slag and waste material from the furnaces is ground and cleaned in the department located at one end of the brass foundry, and the metal so recovered either used in the mixtures, or sold to dealers in this class of material.

The castings are cleaned and trimmed in the department under the metal pattern shop, which is situated at one end of the brass foundry. This department is equipped with metal band saws, trimming presses, grinding machinery, pickling vats, sorting tables, etc.

The vault for the storage of patterns and matches is also located at one end of the brass foundry and underneath the metal pattern shop. This vault is so situated that it can receive light from outside windows without incurring fire risk. The matches and patterns

1. PATTERN VAULT SHOWING PASSAGE AND RACKS.
2. RECEIVING AND INSPECTING ROOM OF PATTERN VAULT.

are supported on iron shelves carried on iron racks. The only timber work in the room which could burn is the 7/8-in. floor, the ladders and the receiving table and desk of the man in charge of the pattern vault. The general construction of the vault is shown by the accompanying illustrations.

METALLOGRAPHY APPLIED TO FOUNDRY WORK.

BY ALBERT SAUVEUR.

In this series of short articles, I propose to present as concisely and simply as possible the elements of Metallography with special reference to the application of this testing method to foundry work I shall avoid dealing with hypothesis or with theories, which are still to a great extent of a speculative character, as well as with scientific considerations of no immediate practical application. In short it will be my aim to convey such a knowledge of metallography as will be of value to those engaged in the production of castings.

The Fracture Of Cast Iron vs. Its Micro-Structure.—As is well known, foundrymen from time immemorial have been in the habit of judging of the grade of pig iron by the appearance of its fracture. In recent years moderately successful efforts have been made to replace this relatively rough and uncertain test by the more accurate and scientific method of chemical analysis. Many foundrymen, however, are still guided by the appearance of the fracture in selecting pig iron for their mixture. With all its shortcomings and limitations, the fracture test undoubtedly furnishes to the trained eye much reliable information regarding the chemical composition of the iron. The reason for this is to be found in the close relation which exists between the aspect of the fracture of a metal and its physical and chemical characteristics. Indeed it may be confidently asserted that any treatment which affects the chemical or physical properties of a metal will also affect the appearance of its fracture. If this be so, it only remains for us to learn how to read and interpret these changes in the aspect of the fracture in order to obtain the needed information regarding the properties of the metal. As might well be expected this will demand considerable experience on the part of the observer. The fracture of a metal is not an open book in which any one may read. A long preliminary schooling is generally required and even to the proficient student, the book yields, undoubtedly, but a very small part of the secrets which it encloses. The little which it does yield, however, is generally of sufficient value to warrant the effort of acquiring the necessary training. Many instances of notable proficiency in fracture reading are on record, such, for instance, as the remarkable accuracy with which skilful and experienced smiths are able to determine the refining heat (recalescence point) of steel by the appearance of the fracture, and the close estimate made by crucible steel makers of the carbon content of their steel based solely upon fracture inspection. If it be considered that in this study of fracture reading we have hardly passed the spelling stage, we may confidently expect fruitful returns as a reward for further endeavor.

Seeing the closeness of the writing and the jealous care with which the metal seeks to hide its secrets, it was quite natural that metallurgists should have called to their assistance those instruments of modern research which in other fields had been used with such wonderful results, namely the magnifying glass and the compound microscope. In examining the fracture of metals by means of a magnifying glass we are occasionally able to obtain information which the naked eye could not secure, but it is, on the whole, of but slight assistance. The examination of the structure of metals, on the contrary, by means of a compound microscope opens up almost unlimited possibilities. A wonderful light is thrown on the page which we were reading so laboriously; new words—new sentences—appear, and we have taken a step forward in our knowledge of metals which mark an epoch in their study.

The compound microscope, however, cannot be applied to the examination of fractures, the magnification which it yields being so great that only perfectly plane surfaces can be observed. The inequalities of a fracture when so highly magnified become as many mountains and valleys: if we focus our eye upon the summit of a mountain the valley will be so far away as to be but dimly visible, while if we bring the valley within visible distance, the mountain tops lie so near our eye as to be quite undistinguishable.

In order to apply the microscope to the study of metals, it is, therefore, necessary to use polished sections, suitably prepared. The micro-structure of the metal is in this way revealed. That a close relation must exist between the fracture and the micro-structure seems likely, if not certain, but the fracture is

like a page roughly written with a blunt pen which can be read only imperfectly and with much labor, while the micro-structure may be compared to a beautiful page of calligraphy in which every letter is perfectly formed.

It will be seen that the microscopical examination of metals may be regarded as an extension of fracture study. It is still an inquiry into the properties of metals by an ocular examination of its structural components, but it is an infinitely more searching and effective method than mere fracture study with the naked eye.

The superiority, in some respects, of the microscopical examination over chemical analysis may be shown by the following considerations: The properties of a metal do not depend so much upon its ultimate composition as upon its proximate composition. Some substances may have exactly the same ultimate composition and still have widely different properties because they differ in proximate composition. The chemical analysis of metals as conducted at the present day furnishes us only with the ultimate composition, that is with the percentage of the *elements* the metal contains: it yields no information with regard to the way these elements combined with each other to form the metal; in other words it fails to suggest its proximate analysis. The microscopical examination of a metal, on the contrary, is a step, and a most important one, towards this proximate analysis. It reveals the constituents of the metal such as they exist. It does not tell us that the iron contains so much carbon but so much carbide of iron (Fe^3C), and it shows the way in which this carbide of iron is associated with the balance of the iron; it does not merely give the amount of iron present but the number of grains of iron with their size, shape and distribution.

Again it is well known that slight changes of heat treatment may greatly affect the properties of a metal, while it generally leaves its ultimate chemical composition unaltered. In this connection chemical analysis utterly fails to assist us in detecting and interpreting these changes. The micro-structure of the metal on the contrary is closely related to any change of properties, and the effect of heat treatment may always be detected in the structure.

THE TECHNOLOGY OF METALLOGRAPHY.

Polishing.—As already mentioned in order to examine the structure of cast iron under the microscope it is necessary to prepare a polished section of the metal. As it is, of course, desirable to shorten as much as possible this operation, it is recommended that sections be prepared not exceeding one-half inch square or ¼ square in. in area. After a little practice and with the assistance of a suitable polishing outfit, the time required to prepare a sample of this dimension should not exceed 10 minutes. Larger samples will demand considerably more time.

Samples of cast iron suitable for microscopical examination may readily be cut from test pieces or other castings by means of a hand hack saw, or better still by means of a power hack saw. Samples of white cast iron must, of course, be broken or cut with a thin emery disc.

The polishing should be conducted with care and a surface produced quite, if not altogether, free from even the minutest scratches, because such markings when highly magnified might seriously interfere with the resolution of the structure.

If the sample has a very rough surface some time may be saved by filing it with a smooth file. It is then ready for the polishing operation.

To remove the file or saw marks and obtain a surface free from scratches the sample must now be rubbed successively over several abrasive substances of increasing fineness for it is not possible to obtain such a specular surface in one operation; the transformation must be gradual.

In the following pages it will not be attempted to review the various methods which have been advocated by different workers, but merely to describe briefly those methods which I have found to yield the most satisfactory results.

Hand Polishing.—Roughly speaking the polishing of samples of metals for microscopical examination consist in three treatments: (1) two or more polishings with emery (or carborundum) of increasing fineness, (2) polishing with an intermediate powder such as tripoli, crocus, diamontine, etc., and (3) polishing with jeweler's rouge. Some writers recommend the preparation by each worker of his own powders, but I find no difficulty in obtaining very good surfaces with the best grades of the powders of commerce.

While much time is to be saved by the use of some simple polishing machine, the operation may be conducted entirely by hand, in which case the following procedure is recom-

mended. Four very smooth and perfectly level blocks of wood should be obtained measuring, say, 6 by 12 inches and 1 or 1½ inch thick. Upon two of these blocks a piece of cotton cloth should be tightly stretched and fastened by tacks to the four sides, while upon the other two blocks, pieces of fine broadcloth should be similarly stretched and fastened.

A small amount of emery powder No. 80 should now be poured on one of the polishing blocks covered with cotton cloth, and mixed with sufficient water to form a thick paste. This paste should be spread over the block, conveniently by means of a spatula, and with the addition of a little more water, if necessary.

The sample of metal which should have been previously carefully filed with a smooth file should now be rubbed back and forth over this block at right angle with the file marks, without changing its position until the latter have been removed, and replaced by finer markings due to the action of the emery powder. The sample should be carefully washed—preferably in running water—as well as the fingers of the operator, and then rubbed over the second polishing block, covered with cotton cloth and some flour emery of the best quality, precisely as before. The specimen should be held in such a way that the new marks cross the old ones at right angle, because the complete disappearance of the latter can then be more readily detected. The sample, after being carefully washed, is ready for the next treatment. Some of the tripoli powder should be spread, with the addition of water, over one of the blocks covered with broadcloth, and the specimen rubbed over this block until all the markings left by the fine emery are replaced by finer ones running at right angles. After careful washing the sample should now be rubbed over the last polishing block, covered with fine jeweler's rouge and water, until all the scratches have been removed. In the case of grey cast iron many small irregular cavities can be detected by the naked eye, but these mark the location of the graphitic carbon, and will be readily distinguished from scratches. A magnifying glass is very useful in inspecting polished specimens.

The polished sample should now be carefully washed and dried with a soft cloth—preferably an old piece of linen. Where an air blast is at hand, as is generally the case in chemical laboratories, it is advised to dry the specimen by means of this blast instead of drying it with a cloth, because by so doing we diminish the danger of scratching it. Even after drying by the air blast, however, the sample will generally have to be gently wiped with a cloth.

In conducting the polishing operation, the student is advised to press the specimen lightly over the polishing block, especially when using the fine powders. Great care should be taken not to carry any coarse powder over a polishing block upon which a finer powder is used, as the presence of but a few particles of coarser powder will greatly lengthen the operation. It is, therefore, of much importance to keep all the blocks carefully covered when not in use, as well as the bottles containing the powders. Cardboard covers will readily be procured to cover the polishing blocks.

GRINDER FOR PREPARING SPECIMENS.

POLISHING MACHINE.

The use of some simple power driven polishing machine naturally suggests itself to hasten the polishing operation. In Fig. 1 is shown a device which has given excellent results and which is widely used. It consists

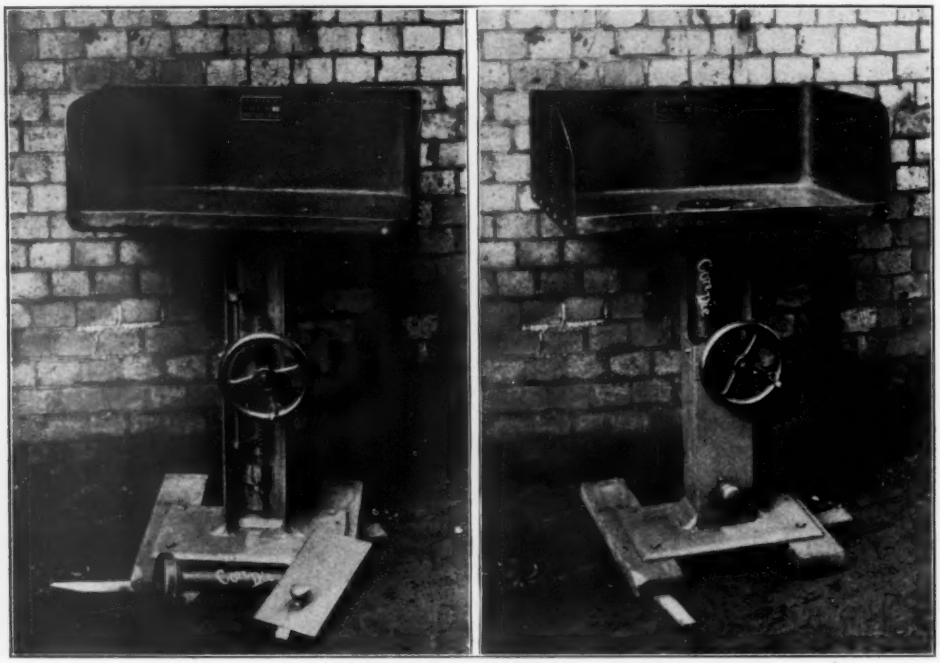
of a grinding machine of the usual style, carrying four discs revolving in a vertical plane: the first disc is an emery wheel of suitable grade, the second a cast iron disc covered with canvas and the next two, wooden or cast iron discs covered with broadcloth. A simple arrangement permits the quick removal of torn cloths whenever necessary. Flour emery, tripoli powder and rouge are respectively applied at the center of the three last discs in the shape of a thick paste, conveniently by means of a brush while the machine is running. Water may be added from time to time as needed in a similar manner. Shields are provided for catching the water thrown off the discs. The sample is pressed in succession over these four surfaces, observing the precautions outlined for hand polishing.

With such an outfit it should not require over ten minutes to polish a sample of cast iron measuring ½-in. square, and frequently a much shorter time will suffice.

A BRITISH CORE MACHINE.

A core making or rather core forming machine, which has several excellent features is shown by the illustrations, Figs. 1 and 2. This machine, while following the lines of some earlier types, is well designed and is also simple and easy to operate. Fig. 1 shows the machine with the working parts exposed, the main portion of the complete machine being in one casting. The top of this is bored and faced to receive the core dies, one of which is shown laid by the foot of the machine; these dies are made interchangeable and are easily removed from the frame, when it is desired to make another size of core. The method of fixing being by means of a bayonet joint, a quarter turn by hand secures the die firmly in its place.

A crosshead and rack carry a piston or plunger rod fitted to suit various sizes of pistons as required, this rack and piston slide on a guide bar fixed to the frame casting; the hand wheel and gear wheel shown move the plunger when ejecting cores.



A BRITISH CORE MACHINE.

On the guide bar a rule is fixed and by setting an adjustable stop to any length desired, cores of that length only can be produced. A vent pin is so fixed that the cores are vented as made, and is removable when not required.

When operating the machine a quantity of sand is placed on top of the table, and after setting the adjustable stop to the desired length of core, the coremaker uses a suitable

rammer with one hand and with the other feeds in the sand, until the die is rammed to the top; then by turning the hand wheel the core is forced out. By having dies with several small sizes the makers claim that an exceedingly large output per hour can be obtained, while with a 2-in. die, cores 6 in. long have been turned out at the rate of eighty per hour.

Two sizes of these machines are made, the A size making cores up to 3¼ in. diameter, and 12 in. long, while the B size will deal with cores to 6 in. diameter and 15 in. in length.

Fig. 2 shows the machine ready for work, and illustrates how neatly Messrs. Riches have protected the working parts from the sand, while keeping them accessible. ZELDE.

SHOT IRON.

We have read with interest the article on page 42 of last copy of *The Foundry* on "Shot Iron."

We have not succeeded in solving the difficulty of using the "shot iron," and we are doubtful that it can be made to pay. In other words we fear that it will be as like "spending sevenpence to mend a broken sixpence."

This foundry has been running for over 100 years, but it was not until lately that we (like a great many other similar concerns) set to, to find out exactly the cost of metal as it runs from the cupola.

We were at once struck by the waste of metal, and also by the manner in which this waste fluctuated.

We have not any machinery for dealing with the cupola dump, etc., but we always screened it, and picked by hand out of it, such pieces of metal as could be seen.

We used to charge it at the end of the cast to make firebars, etc., as it was so hard, that it was not suitable for anything else.

It was very expensive to pick this by hand, and inevitably a large amount of the "shot" had to be thrown away as it could not be recognized from slag.

We then tried putting the whole lot of "shot" into the cupola in small charges towards the end of the cast, so that the metal might be melted out, but then a question arose in our minds as to whether we got a result that paid for the coke consumed, so to define this, we charged the cupola with "shot" only. (Of course we used the usual charge of coke.)

We waited, and waited, and blew, and blew, but never an ounce of metal came out at all.

We would be glad to learn from Mr. James Boyle his experience of the waste of metal per ton of metal put into the cupola, previous to the April he mentions, including the 1200 lbs. per day, also what weight of metal does he melt per day, and what is the consumption of coke per ton of metal put into the cupola, also what weight of gits has he per ton of good castings?

RICHARD PERROTT & SONS, LTD.

Meet us at the A. F. A. Convention, New York City, on June 6th, 7th and 8th.

MAKING SASH WEIGHTS.

BY HARRY MALONE.

In answer to the inquiry which you forwarded to me concerning the best method of making sash weights, I may say that the best method varies with the conditions. Many founders who have a small amount of hard scrap to dispose of that they cannot work into their regular mixture, dispose of it successfully by installing a molding machine using a card of patterns and having the gates so cut that the molds may be stacked. The machine is so arranged that it forms the cope and drags exactly alike, in other words, each piece has a cope side formed in the lower part of the sand body, and a drag side in the upper part. These are simply stacked up in piles about three feet high without clamps or boxes and are poured.

In other cases, a stripping plate or match board is used and ordinary sand flasks made up. This is the usual case with all of the heavier sizes of sash weights. When fitting up to make the smaller sizes in very large lots, I am told that water cooled cast iron chills are frequently used, the chills being placed on end and one side being arranged so that it can be swung out of the way to remove the work from the chills.

The Ansonia Smelting & Metal Co., Ansonia, Conn., are running a small brass foundry employing four molders, and expect to employ four more in the near future.

The Wheeler Foundry Co., of Worcester, Mass., has been incorporated with a capital of $50,000, to take over the business of Edgar B. Pierce, who operated one of the oldest foundries in New England. The officers are, Edgar B. Pierce, president; Elisha Tolman, clerk and treasurer; general manager, Richard P. Power.

Electric Light Wire long enough so Light can be moved from one end of Bench to the other
10"
12"
17"
3" x 4½"
THE PATTERNMAKER
SECTION OF BENCH
Cast Iron Fitting with Set Screws
Time Slips Case
Drawer for Turning Tools 8" x 4" x 30"
Drawer for Brads, Screws and Sandpaper 22" x 20" x 7" with 2 trays
Floor for holding Shellac Pots &c
3" x 4½" x 66"
¾" Gas Pipes
Cast Iron Base
Turned wood Seat for Base
Quick acting Vise
PATTERN MAKERS BENCH
Fig. 1

PATTERNMAKERS' BENCHES AND HORSES.

BY JOHN S. MONROE.

In pattern shops you will find various sizes and designs of benches, drawing boards, etc. I send a few sketches, showing what I think is an up-to-date bench and horse, fitted with cast iron legs. Fig. 1 shows a bench 7 ft. 10 in. long, 31⅝ in. wide and 33 in. high from the floor to the bench top. I have found from experience in a large number of shops that the height given is about right for the majority of men. If a tall man is to use the bench, it can easily be raised and a block put under each leg, so as to give any height required. The bench has two drawers, one at the end for the turning tools, and so arranged that it can be taken out and carried to the lathe while turning. The other drawer is situated near the middle of the bench and is provided with two trays for holding brads, screws, etc., while the bottom of the drawer provides a space for dowels, wax, fillets, etc. This drawer is shown in greater detail in Fig. 2. An electric light holder is arranged upon the tool rack back of each bench, as shown in Fig. 1. This holder is provided with a cast iron base supporting two

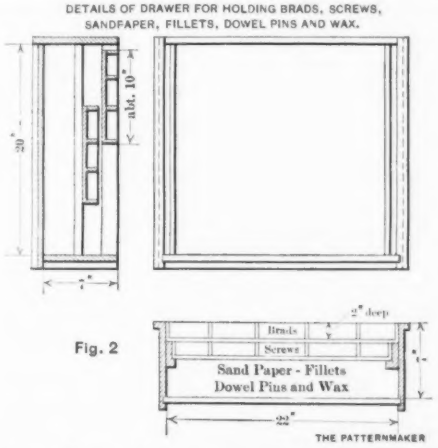


Fig. 2

pieces of gas pipe, so arranged that the light can be adjusted to any required position. It can also be moved from one end of the bench to the other. The tool rack is boxed, leaving an open space in the center. The bottom is open so as to allow dirt to fall out. Such a tool rack protects the cutting edges of the tools.

A horse with cast iron legs is shown in Fig. 3. The bar in the top of the horse can be made of any required length, and if a higher horse is required, a wider bar can be used. The horse can be fastened to the floor with screws if required. The bench leg, with its various dimensions, is shown in greater detail in Fig. 4.

The Wilkes Foundry Co., Toledo, O., has increased its capital stock from $62,500 to $100,000.

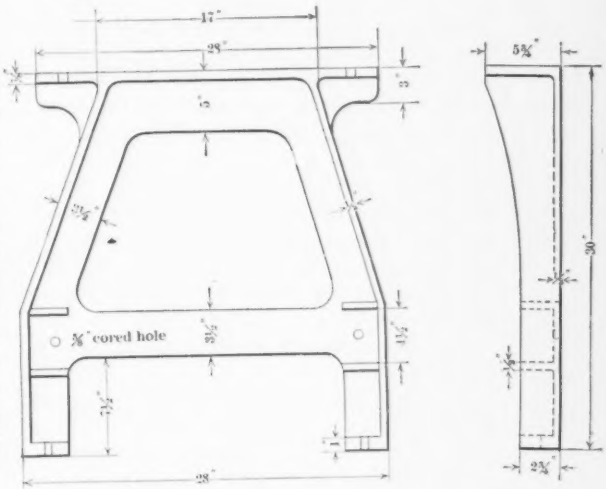


Fig. 4

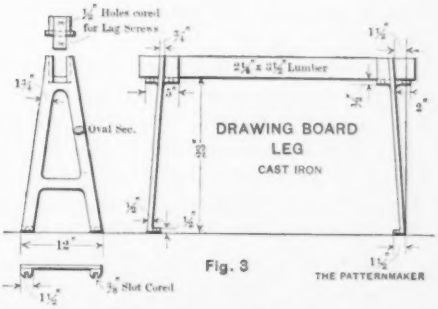


Fig. 3

The open door policy and the free exchange of ideas are responsible for America's supremacy in manufactures. The American Foundrymen's Association stands for mutual helpfulness and better foundry practice. Convention at New York, June 6, 7, and 8.

TEST BARS.

BY B. J. DUNNING.

I am writing this article feeling very much at sea in reference to the question which I have chosen for the title of it, namely: What Does the Test Bar Tell Us?

Now, to begin with, let me ask that I be not put on trial as a heretic, for I have not departed from the faith as taught by the elders concerning the test bar, for I am as orthodox as anyone on the test bar doctrine, but the interpretation thereof is open for discussion, and I am looking for light.

For about five years I have been following the tests to a greater or lesser degree of carefulness, but for the past three years I have been in connection with a company who are striving to excel in quality of iron, and who have been willing to go to considerable expense and trouble to gain that end.

We have a Riehle machine for transverse tests, which also gives deflection. We also have a drop test and a device for taking contraction.

Our tests for each heat are as follows:

We cast three bars 14 in. long to be broken, and also one bar 12 in. long cast in a yoke of that span, micrometer measurement. The 14-in. bars are 1 in. square and are broken on supports 12 in. apart, load applied at center; the shrink bar is also 1 in. square.

I am aware that the square test bar is not held in favor by a great many, but for comparison under like conditions (and the word "like" is not to be taken in its absolute sense) it should answer the purpose. When I began the tests I only took the transverse reading, and by noting the controlling elements in my mixture I got what I thought to be very good results.

Well, being somewhat younger than at present, and very human at that, I followed the way of all flesh and got quite puffed up, and thought that I could regulate things at will, and "predict the things that would come," but as I grew in the business, and began taking tests in deflection, contraction, drop or shock, etc., I found that I yet had some things to learn, and that the sure ground of *my* certainty (?) was slipping from under my feet, and that I was getting into a region of uncertainty, and up against conditions that were not so easily controlled as I had thought. Now, I hear someone say that if we can duplicate conditions each day, that we ought to get like results, but any one who has ever run a foundry knows that it is a mighty hard thing to duplicate conditions only in a relative sense.

Indeed, we do try to keep things uniform, the same percentage of the different irons charged in the same way, and handled from the spout in the same manner each day.

The test bars moulded by the same careful man, gauged and tested in the same manner, care being taken to place bars in devices for testing the same side up, and keeping them that way throughout all the various tests, and after this a difference of 300 to 600 lbs. in transverse strength is found very often.

As we use from 35 percent to 60 percent of scrap it might be thought that the variation may be accounted for in that fact, but when we come to narrow our comparisons down from different heats, to the same heat, or better yet, to two pieces of the same bar, it certainly becomes confusing and hard to explain.

Now, before we rigged up our drop test I thought I could, by comparing transverse breaking point with deflection and contraction, tell whether an iron would stand a shock of a greater or lesser degree before breaking, but I declare to you I have been so surprised at the way the proportions and comparisons jump around that I am brought to a point to feel that "these things are too wonderful for me," and "their ways are past finding out," but of course this feeling comes because I am not well informed as to the causes, and this piece is written in the hope that some good brother will throw out the life line and give me a lift.

Now here are some of the things that come up to trouble the "unwashed."

In the first place if you were to come into our little box stall (OFFICE) you might see great gobs of writing pads covered with figures and calculations something like this:

No. 2 Hubbard Scotch at 1.75 Si. use	30%	=5250
No. 3 Hubbard Scotch at 1.45 Si. use	20	=2900
Scrap (Home) Est, at 1.80 Si. use	50	=90
	100	17,150
Estimated loss in melting	.20	
Si. in mix	1.51	

And likewise calculations for the other elements, and often checking these over to make sure we are O. K. we think we have something good and we try it.

Now the above mixture ought to give a

strong close iron, just what we want for certain castings.

After charging what we want of the above mixture we figure for a softer mix by using a different proportion and adding enough ferrosilicon to balance it up to where we want it.

The next morning I say to my office man: Ed. you get those test bars ready for testing and I will show you a bar worth seeing.

So Ed. gets the bars and we gauge them and proceed with our testing, starting with the strong (?) one. Now that bar ought to go 2800 or 3000 before breaking as they sometimes do, but behold this one, lets go at about 2300 or 2500, but the deflection is good 19-100 so we predict it will stand a severe test on the drop 12 or 16 blows at least.

Now our bars on being broken on the transverse machine leave two pieces about 7 in. long, which we use for our drop test, so you see we have two trials on the drop to one on the transverse.

Our drop tests are as follows: A weight of a given heft falls a given distance (which distance may be regulated) striking the pieces of test bars placed in position.

Well we place one piece in position and let the weight fall *once, only once,* and bang goes the test bar broken as easily as a moulder's New Year resolution. But we have one more trial, and we put the other end of the same bar in position and it stands thirty-five or forty blows from the same weight, falling the same distance, so our stock goes up a little at this, but what have I learned from my test bars? Chiefly that I am more positive, that I know that I don't know, and perhaps that's a good place to get a start for knowledge.

Of course I am aware of this fact: that when we get under certain limits, we are not getting a satisfactory iron, and as a constant prod to our watchfulness in this direction the test bar is all right as it keeps us dissatisfied, and "dissatisfaction is the main-spring of progress." But as to their being a sure guide in telling us the strength of the iron that we are getting in our castings, I am afraid that they do not always tell the truth, at least they do not within quite a range, I think.

And as to formulating a mixture that will give a test bar, or an iron of a uniform character day after day, in all respects seems to me to be a hard thing to do, for after we have the chemical composition where we want it, there seems to be so many physical conditions that can effect our iron and test bars, that it appears to me that it is only within quite a range that we shall be able to get our results uniform in every day practice, under the conditions which prevail in most shops, and over which we at present have very little control.

Now I expect somebody will come back at me and talk about "molecular structure" "crystaline formation," etc., and other fine haired points; well we recognize all these factors, but how are we going to control them? and do the test bars tell us much about our castings? When a bar only 14 in. long, broken in two pieces, can show such a wide difference in each piece we wonder if we are getting very near the truth after all.

We always take a test bar from the crane ladle just before pouring certain castings, and sometimes when one of these castings is bad, and we have to break it we find that, although the test bar for that particular casting was a weak one in all its tests, that the casting itself is one of the hardest ones to break, the iron will be close and tough and as strong as any grey iron could be expected to be.

And again under the same circumstances the opposite will be true, and again we wonder what the test bar tells us? Now these various tests and observations were not taken in a careless haphazard manner, but with a carefulness which comes of a desire to get at the truth of the matter.

Now I would like to know if there are others who have been troubled in reaching a satisfactory conclusion in this matter, and just what they have decided as to "what the test bar tells us?"

Send your foreman to the American Foundrymen's Association Convention in New York, June 6th, 7th and 8th.

Messrs. E. H. Mumford and C. S. Lovell, who have formerly been connected with the Tabor Mfg. Co., of Philadelphia, Pa., have formed the E. H. Mumford Co., of Philadelphia, Pa., and will manufacture molding machines. They expect to develop a special line of machines which will be very strong and efficient, and will also contain a number of new and valuable features. The latter will be thoroughly covered by patents.

The Central Foundry Co., Vincennes, Ind., will put in operation a second cupola to increase its capacity. The report that the company expected to build an addition to its plant is erroneous.

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CONTENTS.

Brass Foundry of the Yale & Towne Mfg. Co., Stamford, Conn. 103
Metallography Applied to Foundry Work. 105
A British Core Machine 108
Shot Iron 109
Making Sash Weights..... 109
Patternmakers' Benches and Horses..... 111
Test Bars 112
Trade Outlook 114
Convention of the American Foundrymen's Association 114
Winona Technical Institute Trade Schools 115
Back Numbers of *The Foundry*..... 115
Railroad Rates to the A. F. A. Convention 115
Fresh Air 115
Headquarters of the Associated Foundry Foremen at the A. F. A. Convention.. 116
Manganese Bronze 116
Pattern Shop System 118
Associations and Societies..... 125
Testing of Fragility 125
Reviews 136
Metals in Foundry Practice..... 138
Cast Iron Notes 138
Brass Foundry Notes 139
Malleable Cast Iron Notes..... 140
Fluor Spar 140
A Large Piston Ring..... 141
New Books 141
Removal of American Steel Foundries.... 142
Summer School for Artisans..... 142
Prize Offer 142
Casting in Brass Molds 142
Revolving Brushes 143
Personals 143
Deaths 143
Fires 144
New Construction 144
General Industrial Notes 146

TRADE OUTLOOK.

The month of April shows no startling developments in the trade outlook. It has simply been a month of healthy growth in the trade, with very slight changes in prices, either of raw material or finished product. There is evidence in many regions that the general jobbing trade is picking up to quite an extent. Many of the special foundries, especially the pipe foundries, have been exceedingly busy for some time, and the general foundry trade is beginning to feel the same revival. It is natural that the heavy work foundries would be the last to feel the movement, on account of the fact that their work comes as the result of extensive improvements and extensive installation of power plants, etc.

The price of Southern foundry iron is held pretty steadily at $13.50 per ton for No. 2 foundry at the furnace, while Northern furnaces are asking from $16 to $16.50 at the furnace. Foundry coke at the ovens in the Connellsville region brings from $2.65 to $3.

The general indications are that the summer will be a fairly busy one. Many of the blast furnaces are closing contracts for iron to the end of the year, and some few contracts have been placed for the first quarter of next year.

CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

The eighth convention of the American Foundrymen's Association will be held in New York City on June 6, 7, 8, and possibly on the 9th also. Arrangements are now being made for headquarters, hotel accommodations, and reduced railroad rates, announcements concerning which will be made later. The indications are that there will be a very large attendance and a large number of interesting papers will be presented, but it is especially urged by the secretary that those interested in the foundry business throughout the country send anything which they have that they think would be of interest, in the shape of papers or subjects for discussion. We believe that the able work of Dr. Moldenke should be appreciated and assisted by the foundrymen throughout the country by sending in such matter for the convention, as only in this way can the greatest amount of valuable information be brought together and the association be made of the greatest benefit to its members and to the foundry business in general. It is stated that special pains will be taken to take care of the ladies at the conven-

tion, and it is hoped that there will be a large attendance.

WINONA TECHNICAL INSTITUTE TRADE SCHOOLS.

The Winona Technical Institute, which is located at Indianapolis, Ind., is starting a series of technical courses giving instruction in various trades, the intention being to enable the students to master trades much as they would in the old apprenticeship days. They already have in existence courses in lithography, electrical work, and house, sign and decorative painting. They are now planning to start a course in foundry work.

A number of prominent foundrymen throughout the country are interesting themselves in the subject, and it is hoped that before long there will be a well equipped foundry, capable of turning out both good castings and good molders.

The foundrymen of this country must certainly arrange to support some system of education by which molders, foundry foremen, etc., will be educated. With the increasing specialization of our foundries it becomes more and more necessary that such education should be imparted by some institution in which the education of the workmen is one, if not the prime, object of the institution, and it is to be hoped that the proposed school in connection with the Winona Technical Institute will fill this long felt want.

If these results are to be attained, however, it means that the foundrymen throughout the country must rally to the support of this institution, both with the necessary funds and with the necessary moral support in the way of interest in the school, to see that the instruction is carried on properly and also to see that the shops always have an abundant supply of work.

BACK NUMBERS OF THE FOUNDRY.

One of the prominent engineering libraries in New York City wishes to complete their file of *The Foundry*, and as our files are exhausted for many of the numbers, it is impossible for us to furnish them all of the numbers desired, and we would like to know if some of our many readers who have preserved the paper cannot furnish the numbers required. These include Nos. 1 to 54, which represent a little less than the first five years of *The Foundry*. They also lack Nos. 91 to 98.

The library is willing to pay a reasonable price for them, but their funds are limited, and as the placing of this file in the New York library will place it in a position where any engineer visiting New York can consult it, we hope that some of our readers will be able to send in the desired numbers.

RAILROAD RATES TO THE A. F. A. CONVENTION.

Dr. Richard Moldenke, secretary of the American Foundrymen's Association, notifies us that the Eastern Trunk Line Association has granted a 1 1-3 rate on the certificate plan. In this connection it will be necessary for each delegate to pay full fare to New York and secure a certificate from his local ticket agent at the time he purchases his ticket. When this certificate is countersigned in New York, it will entitle him to purchase a return trip ticket for one-third fare.

We wish to urge upon all who attend the convention the necessity of securing these certificates, as it is necessary to have a certain number of them to secure the rebate, but if members are careful in this point, there should be no difficulty whatever.

Plans are being made for a general excursion of special cars over the Lake Shore Line, which will enable those wishing to attend the convention from Milwaukee, Chicago, Cleveland, Erie, Buffalo, and the territory tributary thereto, to go to the convention in the same train.

Definite announcement concerning this plan will be made later, or any one wishing information can write to the office of *The Foundry* in Cleveland.

FRESH AIR.

With the rapid increase of our manufacturing industries many exceedingly smoky cities are appearing in the United States. Manufacturing cannot be carried on without the making of drawings and the smoke and dirt from the shops is always a big nuisance in the drawing rooms and offices. This department could undoubtedly be carried on much more economically if clean air, free from dust could be furnished to the workmen. That this can be accomplished has been proven by the fact that in building the H. K. Porter building in Pittsburg a system for cleaning and preparing the air has been installed. The equipment was designed and installed by the B. F. Sturtevant Co., Boston, Mass., and consists of fans which draw air in through a regular coke scrubber

such as is used for purifying gas. This consists of a frame work containing coke, over which water trickles. The water absorbs the dust and dirt and carries it to the bottom of the structure, where it is removed. After the air has been washed clean it is heated and circulated through the building. The fact that a slight pressure is kept on the building continually by the ventilating fans results in outward leaks at all points and this effectually prevents the introduction of outer air. The same plant can be used for furnishing cool pure air in the summer by simply omitting the heating operation.

HEADQUARTERS FOR THE ASSOCIATED FOUNDRY FOREMEN AT THE A. F. A. CONVENTION.

The Murray Hill Hotel, Forty-first street and Fourth avenue, has been selected as headquarters for the Associated Foundry Foremen during the A. F. A. Convention in New York City, and there are indications now that there will be a large number of foundry foremen in attendance.

MANGANESE BRONZE.

BY PERCY LONGMUIR.

The chief application of manganese in metallurgy is that of a deoxidizer and to some extent as a desulphurizer. In these two respects its application in steel and cast iron is familiar. However, quite apart from cleansing action, the presence of manganese in an alloy confers distinctive properties. With bronzes, such alloys are known as "high tension" and they give in comparison with ordinary bronzes high breaking loads and fair ductility. For instance the following tests were obtained from a sand casting:

Max. Stress Tons per sq. in.	Elongation percent.
28	26

Therefore in view of these high values and of the practical interest possessed by manganese bronze it will not be without interest to examine some of the properties of this alloy.

Manganese bronzes are essentially yellow brasses containing greater or less amounts of manganese, iron and aluminium. The two following are typical analyses of commercial bronzes one containing aluminium and the other iron.

Analyses of Manganese Bronze.

	1.	2.
	—	—
Copper	53.0	60.0
Zinc	42.0	38.0
Manganese ...	3.7	0.5
Aluminium ...	1.3	...
Iron	...	1.5

Evidently in the first case cupro manganese has been used, whilst in the second ferro-manganese has been employed to add the manganese. The low content of manganese in No. 2 will also be noted and it may be remarked in passing that many of the so-called manganese bronzes contain no manganese, although the cleaning action of this metal may have been utilized in making the alloy. Very often when manganese is low or absent, aluminium and iron are present in distinct quantities. Naturally these elements exert some influence on the final properties and it will be well to quote the individual effect of each element first.

As manganese bronzes represent high zinc alloys with additions, such an alloy without additions will form a suitable base for comparison. Thus an alloy containing approximately 60 percent copper and 40 percent zinc will when cast under the best conditions yield the following mechanical properties.

Max. Stress Tons per sq. in.	Elongation percent.
18.0	15.0

If to this alloy 1½ percent of iron is added and zinc reduced by this amount the breaking load will be increased by about four tons per square in., whilst the extensibility will remain the same. The iron must of course be alloyed with the copper and zinc and not held in suspension as mechanically free iron. Aluminium added to a high yellow appears to have a very variable action on the mechanical properties. However, ignoring as far as possible these variations, the presence of aluminium in low quantities appears to raise the mechanical properties. Thus 0.5 percent of aluminium added to an alloy of 60 percent copper and 39.5 percent zinc gave an alloy which in its cast condition yielded a breaking load of 20 tons per square inch and an extension of 25 per cent. When aluminium exceeds 2 percent, the tensile strength of the resulting alloys shows a considerable increase which is, however, associated with a marked decrease in extensibility and some increase in fragility.

Manganese added to a high zinc alloy increases tensile strength and extensibility. Thus

60 percent copper, 38.5 percent zinc and 1.5 percent manganese in the cast condition yielded a breaking load of 22 tons per square inch and an extension of 30 percent.

From the foregoing it is evident that iron, aluminium and manganese, when individually present in amounts not exceeding 1.5 percent considerably increase the mechanical properties of the resultant alloys. That this increase is maintained when the three are collectively present in a copper zinc alloy is shown by the tests already given of a typical manganese bronze. The complexity in composition of manganese bronze is readily shown by the foregoing notes. This very complexity suggests several features of which we will note a few of the more important.

The base of a high tension manganese bronze has been stated as approximately 60 percent copper and 40 percent zinc and the tensile properties of such an alloy have been given. Turning to an alloy of lower zinc content, the following tensile tests are typical of an alloy cast under the best conditions.

Copper percent.	Zinc percent.
73	26
Max. Stress Tons per sq. in.	Elongation percent.
12.5	40

Comparing these figures with the 40 percent zinc alloy it will be noted that the tensile strength is lowered by 5.5 tons per square inch, whilst the elongation is 25 percent higher. Therefore in order to obtain the necessary tensile strength the content of zinc must be comparatively high in the base used for the production of a high tension bronze. A content of 38 to 40 percent zinc gives the requisite rigidity, whilst the additions of aluminium and manganese, partly by their individual action on the alloy, but probably more by their "cleansing" effect, and tendency towards the product of sound and close grained castings, contribute largely to the maintenance of high ductility. Iron as already shown increases the tensile strength. However, this metal is not purposely added, its presence being the natural result of the employment of ferro manganese as a source of manganese.

The usual precautions essential to the production of any alloy are necessary in the case of manganese bronze, it may be well, however, to specially emphasize the three following: 1, loss of zinc; 2, casting temperature; 3, method of casting.

Loss of zinc.—During fusion a considerable loss of zinc occurs, the actual amount lost varying with melting conditions and atmospheres. In any case this loss is seldom below 25 percent, but should be determined for the conditions under which the alloy is melted and allowed for. If large quantities of ready mixed alloy are melted in an air furnace, the best method of allowing for the loss during melting is to add the requisite quantity of zinc to the ladle before tapping.

Casting temperature is of exceptional moment. Reverting to the dual copper zinc alloy the following tests show the influence of varying casting temperature on the tensile properties of castings poured from one crucible within a short interval of each other. Chemically the three castings are identical.

Copper Per Cent.	Zinc Per Cent.	Casting Temperature C.	Max Stress Tons Per Sq In.	Elongation Per Cent
58.6	40.5	1038	12.45	6.0
		943	16 28	9.5
		937	18.88	15.0

The writer has examined many types of alloys and in every case similar temperature variations have a similar effect on the mechanical properties. The following results obtained from manganese bronze were obtained by Guillemin:

Casting Temperature °C	Max Stress. Tons per sq. in.	Elongation percent.
1400	15.2	13
1300	19.7	45
1250	21.6	35
1200	22.9	30

These results sufficiently emphasize the importance of casting at a suitable temperature. In judging a suitable heat the appearance of the alloy in ladle or crucible is at present the only guide. With manganese bronzes this appearance is somewhat confused by the aluminium present, for as is well known this imparts a characteristic skin to the surface of the molten alloy. The practical effect of this is to make the alloy appear colder and less fluid than is really the case. However, careful observation readily overcomes this difficulty.

Casting Manganese Bronze.—Manganese bronzes have a high contraction coefficient, hence if the casting is at all likely to "pull" it should be eased in the mold soon after solidification. In order to obtain castings free from "draws' large gates and rising heads are essential. For large castings "plug heads" should always be used. This type of head is familiar being simply a dry sand head with a plug fitted into the runner. The head is filled with metal

and the plug lifted, the ladle keeping a constant level of metal until the mold is filled.

PATTERN SHOP SYSTEM.

BY OSCAR E. PERRIGO, M. E.

There is no department connected with the modern machine shop in which a good system of management, administered by a careful, methodical man, in a quiet and orderly manner, will be of more benefit to the establishment in general than the pattern shop. It is too often the case that this department is looked upon as being non-productive; a source of continual expense; not producing anything which may be sold at a profit; and consequently should be managed as cheaply as possible. Therefore we see the pattern work done in a part of the shop not at all fitted for such work, possibly in one end of a machine room and subject to the iron dust and dirt which is not shut out by even a board partition, and sometimes by one only half the height of the room. We find it poorly equipped with inadequate and often obsolete machinery, supplied with poor lumber and lacking many of the essentials for producing good work. Often men are employed because of the low wages they are willing to work for, rather than those of the requisite ability in their chosen trade.

There is always a vast difference between cheapness and economy, as the terms are generally understood, and these false ideas of economy generally result in the expenditure of more money finally than if such short-sighted ideas gave way to the policy of seeking for the best, being willing to pay for it, and then expecting high efficiency of employes and the production of good work that would stand the test of hard usage, rather than that which must be frequently repaired and strengthened in order to keep it in use.

While these facts should be strenuously adhered to as to the regular work of the pattern shop intended for permanent use, we should not lose sight of the occasional jobs of pattern work intended for only a few castings, and therefore should be made with this end in view, and often at one half the expense of a thoroughly made, permanent pattern.

That there has been a good deal of improvement along these lines within the last few years is undoubtedly true, yet the fact remains that there is still in many shops room for more changes for the better, both in matters of economy of expense and a higher standard of workmanship.

The following plans and systems of handling the work are the result of practical experience as well as years of observation of this and kindred work and it is hoped that they may offer practical suggestions to men having the responsibilities of administering the affairs of such a department.

In arranging the working force of the pattern shop a definite plan should be followed. This plan will depend to a great extent upon the kind of work that is to be done. That is, whether it is to be for large, medium, or small pattern, or perhaps a portion of each. Also, whether it is to be a good deal of new work, or a large proportion of the work is in altering patterns, or changing standard parts of them. In any event the one essential point to be considered is, to employ skilled, or high priced pattern makers only on such work as need such ability, while all work that can be done by apprentices, or less skilled men, shall be done by them. For this reason, getting out dimension lumber, making core prints, bosses, varnishing and marking patterns, and similar work, may be done by men at from half to two-thirds of the pay that the skilled pattern maker receives. Therefore such machines as the planer, jointer, circular saws, etc., may be handled by the men who may be classed as "mill men," who, while they are not conversant with pattern making as a trade, can get out such dimension lumber as the pattern makers require in less time and at much less cost. So it is with the man running the band saw in getting out segment work, and then laying it up. Being employed on this class of work continually, he can, not only do just as good work, but sometimes better, than a man who only does it occasionally, and of course, do more of it and do it more economically. Putting in fillets, puttying, plugging screw-head holes, varnishing and rubbing down patterns, etc., is the work of an apprentice and not that of a skilled workman.

To obtain the most efficient and economical results from this department, assuming that the work will be in the usual proportion of new work, alterations, repairs, etc., its force and the duties of the men should be classified somewhat as follows: A force of 14 employes would consist of say, one foreman, six skilled pattern makers, one lathe man, one planer man, one circular saw man, one band saw and segment man, one finisher and varnisher, one man for keeping pattern records, lettering patterns, etc., and one laborer. For a force of ten employes there should be: one foreman, four skilled pattern makers, one lathe man, one

band saw and segment man, one man for keeping pattern records, finishing, varnishing and lettering patterns, etc., and one laborer. For a force of seven men there would be: one foreman, three skilled pattern makers, one lathe, band saw and segment man, one planer, jointer and circular saw man, and one man for keeping pattern records, finishing, varnishing and lettering patterns, etc. A laborer must be called from the yard or some part of the shop when wanted. By finishing a pattern, is meant putting in fillets, plugging screw-head holes, puttying, etc. In a force of ten men the lathe man will do whatever other work the foreman desires when he is not engaged on his special work. The man who keeps the pattern records looks after the issuing of patterns to the foundry and the storing of them when they are returned. An apprentice should be able to put in fillets, putty, varnish, rub down, etc., and where there are only a few men the foreman will keep the pattern records.

It should be understood that when we speak of a skilled pattern maker we mean one who thoroughly understands his business, and this is a matter not always properly understood by men who have not had practical shop experience in this particular line. He must be able to read drawings quickly and thoroughly. He must have a good practical knowledge of molding from the patterns in the foundry, and of the behavior of the various metals in casting, particularly of the different qualities of cast iron, of their liability to distortion, and the varying degrees of shrinkage He must have a practical idea of the effect of distortion of castings from patterns of different forms and proportions. He should know the correct amount of stock to allow for machining a casting when this is not specified on the drawings, and many other things besides the mere mechanical work of building up the pattern. In this part of the work he must know about the behavior of lumber when made into a pattern; how to so build up his pattern as to secure the greatest rigidity; to so dispose of the pieces of wood composing the pattern that its contraction and expansion shall not distort the pattern, or the wood be split from the severe strains produced by wet sand, which is always a severe trial for a pattern. He must have his pattern divided in a proper place to mold easily and without unnecessary time to be spent by the molder. All of these and many minor points relating to his work he must get by study and experience in order that he may be classed as a skilled pattern maker, and to accomplish this he must be a man of considerable ability to begin with, consequently we must not expect him to be a cheap man.

A great deal of care should be exercised in selecting lumber for use in making patterns and it will usually be found difficult to obtain really first class stock of this character. Properly dried and seasoned lumber is not easily found, and even if it is said to have been kiln-dried it may have been left exposed to damp atmosphere afterwards and so absorbed sufficient moisture to make it necessary to keep it stored for quite a time in order to have it fit for use. It is almost impossible to know just the condition of lumber when it is purchased, either in the rough or planed. It is therefore one of the great conveniences, if not a real necessity, to have a dry-room, heated with a steam coil, so that lumber may be thoroughly "dried out" before being taken into the pattern shop for use. Care should be taken that

Fig. 1

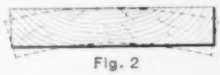


Fig. 2

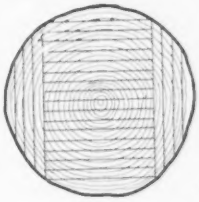
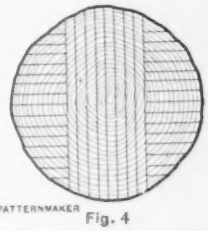


Fig. 3



THE PATTERNMAKER Fig. 4

this dry-room is not kept at too high a temperature, as such a condition will result in "season checks" in the surface and the ends of the lumber, owing to the too rapid contraction of the surface before the center of the plank, or board, is thoroughly dried. And even after it has been through the dry-room it should not be piled up horizontally, with the flat sides together, but kept on edge, in racks suspended from the overhead timbers of the pattern shop, and in which the lumber is held in position by vertical strips. Previous to being placed in these racks the lumber should be planed to certain regular thickness from a quarter of an inch to one inch by sixteenths, and from one inch to two inches by eighths. Lumber thicker than two inches should ordinarily be left in the rough until wanted for use, unless there are many large and heavy patterns to be made. This lumber may be piled horizontally with strips laid between the

planks every six feet or less, and directly over each other.

As to the kind of lumber to be used, white pine is the most common, although much cherry is used for small patterns and should be used for the smaller loose pieces of pine patterns. In the western states the writer has seen butternut used to good advantage for patterns, particularly where the pattern has much hand work with the gouge to be done. It cuts easily and smoothly and is stronger than white pine. Mahogany makes a very nice small pattern, but is unnecessarily expensive for any other patterns.

In selecting lumber for patterns care should be taken to get that which has been properly cut from the log, that is, lumber in which the *edge of the grain shows on the side of the board.* Otherwise it will be very liable to warp, no matter how much care has been taken to dry it, or to keep it well protected. This will be better understood by referring to the engravings. Fig. 1, shows a cross section of a board cut from the log in a proper manner. Fig. 2 shows the result of cutting the board from near the surface of the log, making what is technically known as a "siding." The dotted lines show how it will warp. This is due to the fact that the sap, or outer portion of the log, which is of newer growth is less dense, and will contract more in the process of seasoning.

It is usual to cut up logs in the manner shown in Fig. 3. The boards taken off near the surface of the log are trimmed with an edging saw and should be sold as sidings, for inferior work, but never used as good pattern lumber, unless in a place where they are held and confined so firmly that they cannot warp or distort the pattern. For use as pattern lumber, or for any really good work, the log should be cut up as shown in Fig 4, which preserves the grain in a proper direction as nearly as possible, but is not as economical, as to the value of the lumber, as it makes a number of quite narrow boards. The furniture manufacturers term of "quartered oak" refers to a log cut up as shown in Fig. 5, which is the most nearly correct so far as getting all the good lumber possible out of the log.

Pattern lumber is nearly always expensive, no matter where it may be purchased, and much more care should be used in cutting it up in the shop than is usually the case. If this matter is properly considered and thoroughly understood, very little need be wasted. It is well to have a series of shelves, placed conveniently to the circular saws, upon which such scraps as are likely to be useful may be arranged according to their size or shape, so as to be convenient to find when small pieces are wanted. When a board or plank is cut and a considerable portion of it is left it is customary to stand it up against the wall, or in some convenient corner. This is repeated until a quantity accumulates, the lower ends of the pieces projecting further and further out from the wall, occupying more and more of the floor space, continually "kicked and cussed" until the nuisance becomes unbearable and a cleaning-up process usually results in throwing a good many pieces into the scrap pile. This might easily be avoided by making a rack, consisting of a piece of 3 x 4 in. scantling, in which are fixed hard wood pins one inch in

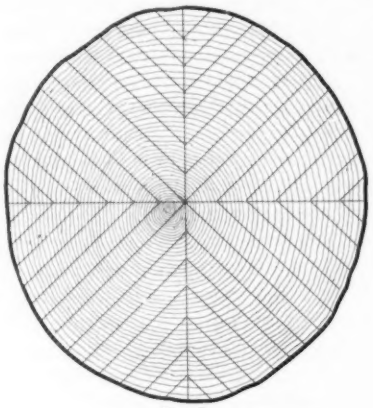


Fig. 5 THE PATTERNMAKER

diameter, placed about six inches apart, and projecting about a foot. This scantling is spiked to the wall in a horizontal position, three to four feet from the floor, with the pins projecting outwardly from it. Pieces of lumber four to eight feet long may be conveniently set up on end between the pins, and any piece wanted may be readily removed without disturbing any of the other pieces. The length of this rack will, of course, depend upon the available space that can be spared for it. One near the circular saws, in addition to the scrap shelves described above, will be found very useful.

One of the best methods of working up the accumulation of small scraps is to have an apprentice make them up into core prints and bosses of all the various sizes in common use, keeping the different sizes in suitable boxes or bins built against the wall. This will, not only use up the scraps, but will save a good

deal of the time of the pattern makers, whose time is too valuable to be spent at this common work.

Another point needs attention in most shops, and that is the too frequent disposition to use first-class lumber for such parts of a pattern as cleats, stop-off pieces, core box backs, the inside framing of a boxed-in pattern, etc., when lumber at half the price would be just as good and cost no more to work up. A considerable saving in lumber bills may be made by attention to these matters, and the standard of good work not lowered for any practical purpose.

Fillets and dowel pins can be much cheaper purchased than made in the shop. A good deal of discussion as to the relative merits of wood and leather fillets has been indulged in. The pattern maker's time will no doubt be saved and good pattern work be the result of using wood fillets for straight work and leather fillets for curves. The patented brass dowel pins should be put into all patterns that are to be in continuous use, and the malleable iron rapping and lifting plates, let into the pattern, should be used on all patterns large enough to need them. A stock of these convenient and very necessary articles should always be kept on hand and ready for use.

The system of marking and listing patterns is usually arranged in the drafting room, and the lists furnished to the pattern shop for use and guidance. The plan recommended is to designate each machine built, by a letter of the alphabet, or a combination of two of them, and to indicate the individual patterns of each machine by numbers. Similar parts of machines of the same type take the same numbers. Thus, if the letter of a machine is B, the patterns will be marked B1, B2, B3 and so on. When a change is made in a pattern, a letter X, is added, making the pattern B3, read B3X. If changed a second time it will become B3XX. Further changes would be indicated by one X, followed by a number to indicate the number of changes that had been made. For instance, if it had been changed the fourth time it would be marked B3X4. If the swing of a lathe is to be increased, or a planer to be widened, by a special order, the new patterns made necessary by this change would be marked with both of the letters indicating the machines, as for instance, the letter K, indicating a 30-in. planer, to be widened to 36 in., the letter being L, the new patterns necessary would be marked K-L, the hyphen being used to indicate that two machines are meant. Where a machine designation necessitates two letters of the alphabet in consequence of the fact that the letters are exhausted by the variety of machines built, the hyphen is omitted. The letters I O X are omitted as designating letters, as the first two so nearly resemble figures, and the letter X, is used to indicate alterations of the patterns.

Pattern letters and figures should be formed with two sharp points on the back, which may be forced into the wood of the pattern and thus hold them securely. The addition of a little thick shellac varnish will hold them more firmly. These letters and figures may be purchased, or they may be cast in the pattern shop, and as a large number of them are used this will be the more economical way to obtain them. A brass mold in two parts, hinged together, may be made, one part having the letters formed in it, and the other with tapering holes for forming the points on the back of the letters. The metal used is lead, to which is added a small quantity of antimony. A still better alloy is composed of lead 70 parts, antimony and bismuth, each 15 parts. The mold is heated over a gas flame, while the metal is melted over a bunsen burner. Care should be taken not to overheat either of these alloys. They should be just hot enough to burn a pine stick to a rich brown.

These letters and figures should be of the style known as sharp faced gothic, size three-eighths, or half-inch, and are used only for indicating the letter of the machine, the number of pattern and the changes that have been made in it. The letters for the name of the firm, or company, which appear in prominent places on the machine, should be also of the sharp faced gothic style and of a size suitable for the available space They should be purchased and kept in stock in proper boxes or cases. Usually three or four sizes will be sufficient. These pattern letters having flat, smooth backs, are often fastened to the pattern with small wire brads, which hold them very securely, but are likely to show roughly on the casting unless the job is very carefully done. A much neater and quicker job may be done by first putting a coat of light shellac on the backs of the letters, then a rather thick coat on the pattern and placing the letters on this before it is dry. In either case a line should be drawn on the pattern for the tops of the letters, and they should all be laid on and the position of each marked before fastening them to the pattern.

The reason for using the sharp gothic style

of letters in preference to roman or fancy styles, is that there is such a large amount of draft to the sides of the letters that they draw very easily from the sand, and also, that for nearly all classes of castings the plainest letters have a much better appearance than the more ornamental or complicated ones.

Pattern letters and figures should be kept in convenient cases or boxes so as to be securely protected and readily found when wanted. The most convenient form of case is that shown in Fig. 6. This case is 20 in. wide and 28 in. long. The strips around the ends and back are five-eighths inch thick and one and a quarter inches wide; the front is the same thickness and one and three quarter inches wide; the bottom being half an inch thick. The partitions are a quarter of an inch thick, and are "notched together" as in a type case. The letter boxes are 3 x 4¼ in., except for the letter X, which is 4¼ x 6¼ in., as many of these are used in marking changes of pattern. The figure boxes are 2 x 3 in., except that of the figure 6, which also answers for the 9, the box being 3 x 4½ in. Each case is furnished with two drawer pulls, and the front should be plainly marked with the size of the letters and figures contained in it.

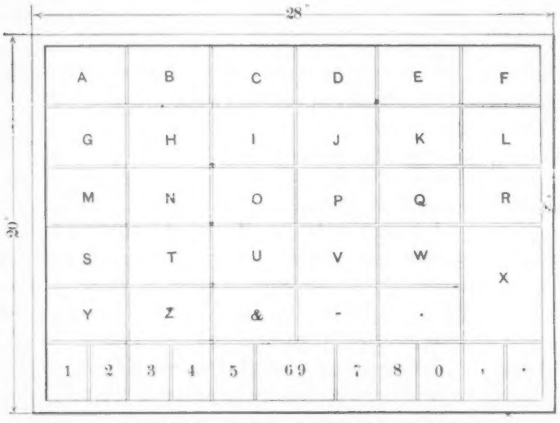


Fig. 6. CASE FOR PATTERN LETTERS AND FIGURES.
THE PATTERNMAKER

The care of wood fillets, so as not to injure the feather edges is important, and a safe receptacle should be provided for them. In order to have these articles, as well as leather fillets, brass dowels, wood dowels, rapping plates, etc., properly cared for and arranged in an orderly manner where they can be readily found, the case shown in Fig 7 is designed to meet these requirements. The lower part of this case is 59 in. wide, 20½ in. deep and 26 in. high, and contains six of the cases for pattern letters and figures, as shown in Fig. 6, twelve bins for malleable iron rapping plates, and three drawers properly divided for holding brass dowels. The upper part of the case is 8½ in. deep and contains at the top, six spaces for wood dowels, and beneath these six spaces for wood and leather fillets, both kinds being placed in the same space. The wood fillets being made in four foot lengths there is ample space for them. This case should be made of ⅞ in. pine, with a back ½ in. thick. It will be found a great convenience, as well as a means of saving these articles from waste and injury.

There should be another case with shelves 10 in. wide for holding steel wire brads and wood screws. There should be shelf room enough to show at the front one package of each size that may be used.

Several other packages of the same size may be piled behind the front one as reserve stock. These cases should not be much over five feet high, and arranged against the walls in such a situation as to be most out of the way and yet convenient for the men to get at. They should be built of ⅞ in. boards. The shelves for any articles as heavy as wood screws, brads, or steel wire nails should be supported by uprights about 30 in. apart. These cases should have two coats of light shellac varnish. It is always best to have these and all similar fixtures present a neat and clean, as well as orderly appearance. It will have a good effect on the workmen and they will take more interest in their work and have more respect for the shop and its management to realize that all these matters relating to their wants are foreseen and properly attended to.

All patterns should be so colored in the varnishing as to show the material of which they are to be cast. To effect this all core prints should be *red*. Patterns for grey iron castings should be *black;* for malleable iron castings, *brown;* for steel castings, *blue;* for brass castings, *yellow;* and for bronze castings, *orange*. These colors may be easily made by the addition of vermillion, lampblack, burnt umber, ultramarine blue or chrome yellow to ordinary shellac varnish. The colors should be purchased in a dry state and cut with a little alcohol before being added to the varnish. The brown and blue may need to be made a little lighter in color, which may be effected by adding a little dry white lead, cut with

alcohol as before. To make the orange, add a little red to the yellow. This method will save a great deal of needless trouble and annoyance from patterns being cast of the wrong material, as colors will always appeal to the eye and are more easily remembered than any written, printed or oral directions.

The pattern loft should be so arranged that the groups of shelves are located between the windows, projecting out from the walls so as to form alcoves, or passages between them about four feet wide. The best form of shelves will be those supported in the center, near each end by a vertical standard of wrought iron pipe, set in a cast iron base resting on the floor. Fixed at proper heights on these pipes are cross bars of cast iron, upon which the planks composing the shelves are supported. This leaves the edges of the shelves clear of any obstruction, greatly facilitating the handling of patterns. A similar arrangement of shelves may be made with wooden vertical and cross supports, the former being fastened to the floor below and the overhead timbers above. Space should be provided on the floor, or on low supports, or a low platform, for large and heavy patterns, so as to have them in a convenient position for handling. Overhead tracks and trolley hoists may run through the center of the pattern loft for convenience in handling large patterns. They may thus be handled very quickly and economically.

In storing patterns in the pattern loft, those belonging to one machine should be confined to one section, or group of shelves as much as possible, the larger ones on the floor or the lower shelves, and the smaller ones on the upper shelves. The name and letter of the machine should be plainly marked on a strip nailed to the front of a shelf four or five feet from the floor. If different colors are used to designate different machines, or types of machines, these signs may be painted the same colors, for convenience in finding such patterns as may be wanted.

The patterns for machines of the same general type should be grouped in one part of the loft, occupying adjacent groups of shelves, if necessary to use those of more than one group. Patterns for castings of malleable iron, steel, brass and bronze should be kept on one of the shelves in the same group as those for grey iron castings. If special shelves for all the patterns for any one of these materials are kept together there is more liability to mistake in sending the proper ones to the foundry.

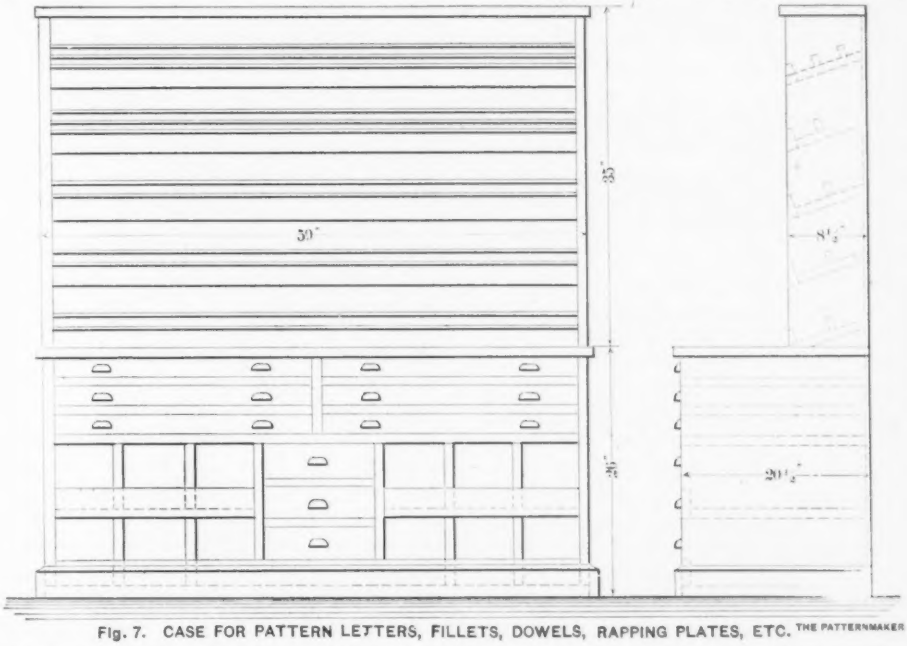


Fig. 7. CASE FOR PATTERN LETTERS, FILLETS, DOWELS, RAPPING PLATES, ETC. THE PATTERNMAKER

The foreman should have a record of the location of all patterns in the pattern loft. The system which will be found to require the least amount of writing and will be the easiest to keep correct from day to day will, no doubt, be the card system. To render this system useful there should be a card for each pattern, and written upon it the letter designating the machine, the number of the pattern, its name, and a list of all loose pieces that should go

with it. These cards may be of ordinary cardboard stock, cut 3 x 4 in. and requiring no printing or ruling. The cards representing the patterns of each machine should be grouped as for instance, an engine lathe, divided into such groups as the bed, headstock, tailstock, carriage, etc., and these groups separated by guide cards, which may be cut 3¼ x 4 in., with these designations written on the exposed quarter of an inch. Such a guide card will stand more hard usage in constant handling than those cut with the usual small tabs.

These cards should be kept in small, plain drawers, each holding the cards for one machine, the letter and name of which will be marked on its front. As cardboard stock may be had in twelve or more colors and shades, these should be utilized for machines of the same general type, as a matter of convenience. Or, if desired, cards of different colors may indicate the material used in the castings. For instance, a grey card for grey iron castings; a brown card for malleable iron castings; a blue card for steel castings; a vellow one for brass castings; and an orange one for bronze castings.

When the patterns are in the pattern loft the cards remain in the usual card drawers. When the patterns are sent to the foundry the cards representing them are moved from their accustomed drawer to one or more large drawers marked " At the Foundry," and are replaced when the patterns are returned. If the dates when these changes are made should be required the cards may be made a little larger, and the dates of the issue and return of the patterns be entered on them with a rubber dating stamp. The backs of the cards as well as the fronts may be thus used. When all available space has been utilized a new card may be made out. There appears to be only one objection to the use of cards and that can be easily overcome by a reasonable degree of care and attention. This is the liability to put a card in the wrong place, thus causing considerable loss of time to again locate it. When a scheme of different colored cards is used the liability of this error is much lessened. The card system still remains the quickest and least complicated, as well as the most flexible one in use at present.

The time of all employes should be kept on cards in a time recording clock, a day time card being registered for the use of the time keeper, and also on job time cards, each of which represents the time spent by a single employe on a single job, or order number, these aggregating, at the end of the week, the same number of hours as the day time cards. In addition to these cards there is a material and cost card, kept by the foreman, which contains, on one side an account of all time spent on the job by all who have worked on it, and on the other side an account of all material used and properly chargeable to that order number. This card is turned in to the cost clerk when the job has been completed. These cards should be 5 x 7 in. and of thick card, ruled and printed similarly to that used for the same purpose in the machine shop departments, except that the articles enumerated will be, white pine lumber, cherry lumber, wood screws, wire nails, wood fillets, leather fillets, wood dowels, brass dowels, rapping plates, pattern letters, etc. The cost of gum shellac, alcohol, glue, dry colors, etc., will be charged upon a percentage plan, the amount used in a month being kept once or twice a year and its relative value to the value of patterns made in the same period being sufficiently accurate for the purpose.

If the system herein described is faithfully, consistently and carefully carried out it will be found to exercise a good effect upon the employes by interesting them in its methodical and orderly management; it will save much time usually lost in this class of work; it will produce more good work with the same number of men, or the same expense; every man will know his duties and responsibilities; the daily routine of the shop will run smoothly and without friction; and there will be a prevalent air of economy and efficiency in the department that is seldom found where the usual methods, with their wasteful disregard for time and material are in vogue. Properly managed, the pattern shop may be one of the best and most economical departments of the entire plant, but carelessly managed it is no small factor in reducing the profits on manufacturing operations.

When you purchase your ticket for the A. F. A. Convention at New York, be sure and be at the station twenty minutes or half an hour early, so as to secure a certificate or receipt from your ticket agent, which will entitle you to a return ticket for one third fare.

The plant of the Toledo Castings Co., Toledo, O., has been sold at sheriff sale to R. W. Kirkley for $9,001, two-thirds of the appraisement.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

Howard Evans, Secretary, care J. W. Paxson Co.

The 146th meeting of the Association was held at the Manufacturers' Club, 1409 Walnut street, Philadelphia, on Wednesday evening, April 5th, President Devlin occupying the chair. Howard Evans, Secretary, read an invitation from Dr. Richard Moldenke, of the American Foundrymen's Association, requesting the members to attend the annual meeting to be held in New York City on June 6th, 7th, 8th, and possibly the 9th. Mr. Evans stated that the 15th anniversary of the Philadelphia Foundrymen's Association would occur in May, 1906, and it was almost a foregone conclusion that the next annual meeting of the American Foundrymen's Association would be held in Philadelphia. The President then introduced Mr. John A. Makem, of the evening School of Accounts and Finance of the University of Pennsylvania, who read a paper on "Foundry Cost Accounts." There was considerable discussion of the paper, after which the meeting adjourned.

Test for Fragility.*

Thorsten Y. Olsen, of the firm of Tinius Olsen & Co., Philadelphia, was called upon to read his paper entitled "The Fremont Method of Determining the Fragility of Iron and Steel."

*Paper read before the Philadelphia Foundrymen's Association on March 1, 1905.

The speaker explained that his knowledge of the subject was based mostly on translations from the French of Mr. Fremont's papers to the Society for the Encouragement of the National Industry, together with a personal acquaintance with Mr. Fremont at Paris in 1900. In addition, he had been able to make various experiments on one of the Fremont machines at the laboratory of Tinius Olsen & Co. The speaker illustrated his address by the use of lantern slides, some of which are reproduced here through the courtesy of the Engineers' Club of Philadelphia. Mr. Olsen said in part:

"According to Mr. Fremont, the test of tension owes its great growth to research work on iron and steel by Mr. David Kirkaldy in 1860, together with the development of the

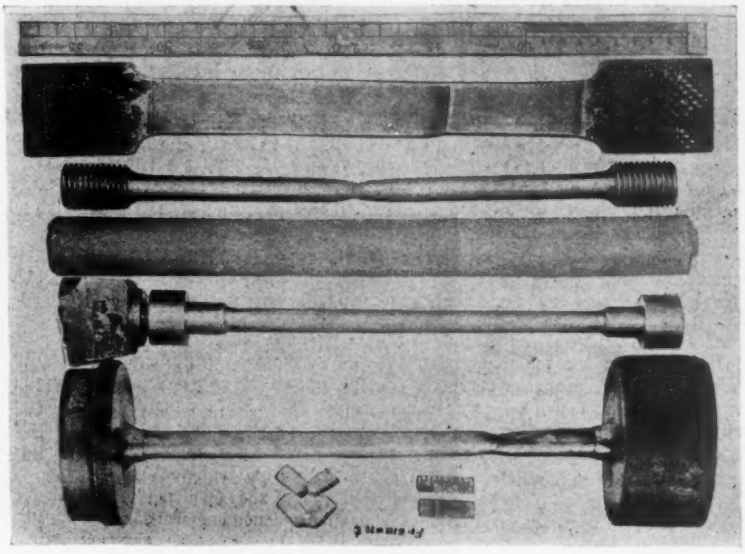


FIG. I.

Bessemer steels. From this time the test of tension increased in importance, while that of shock or impact lessened. With tension testing definite results may be obtained; in fact, the standard machines of today are far more accurate than the homogeneity of the metal warrants. Today all the formulæ on which engineering problems are based are derived from results obtained from tension testing. Standards have consequently been adopted for various materials, varying with the known stresses they may be subjected to.

"Due to the lack of homogeneity of a steel and to the unknown stresses which must frequently take place, factors of safety are stipulated. Thus, if a boiler or a rail is designed properly it should break only by an unknown

fault in the material. Accidents occur; but should they be called accidents when possibly they might be avoided? The defects in the steel are either lack of homogeneity or excessive fragility, or both. While the manufacturer has been plodding on, testing his material as required, being then safe from further responsibility or criticism, the scientist has been endeavoring to obviate, to the best of his knowledge, these two faults of steel. The first fault may be eliminated only slightly by making a greater number of tests; the second, fragility, by an impact or shock test. Today there is an impact test prescribed for a rail; why not for a boiler plate, wheel tire, or any portion of a mechanism subjected at some time or other to an abrupt or intermittent stress?

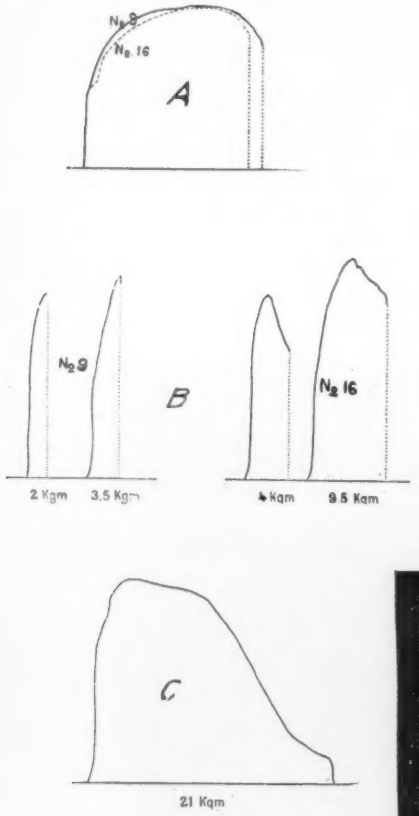
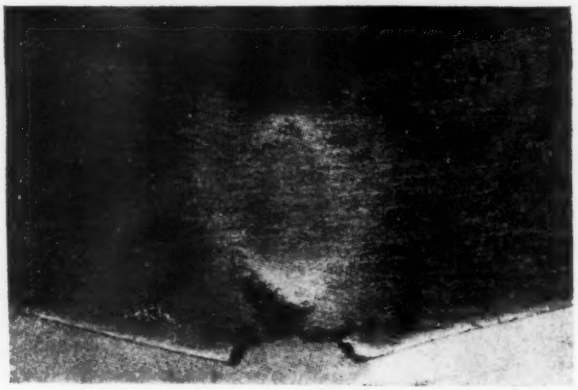


FIG. 2.

"'Fragility' is a known factor as far as the knowledge of its existence, but no further. Through lack of method, machine and standards, the consumer and producer alike have been compelled to ignore the fragility of their steel. Mr. Fremont, intent on relieving this state of affairs, commenced a series of investigations to determine the best means of testing for the fragility of steel.

"In France, testing as done in this country is looked upon as an extravagance, and only the largest companies can afford a moderate sized testing machine. The cost of the material and preparation of tension-test pieces are also considered a great expense, and hence Mr. Fremont, considering this, together with the desire of testing portions of plates nearest to the portion actually used, and of testing thin plates, made his test specimen very small throughout his various experiments. Thus his specimens are 10 mm. wide by 8 mm. thick and 30 mm. long, with a notch cut crosswise in the center of one of its broad sides, 1 mm. wide by 1 mm. deep. Fig. 1 shows the comparison of some tensile specimens with those of the Fremont type. Mr. Fremont first experimented with the bending test, and bent his small specimens



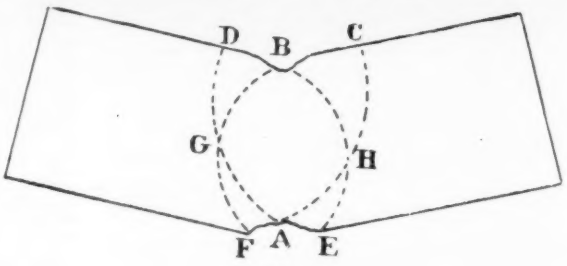


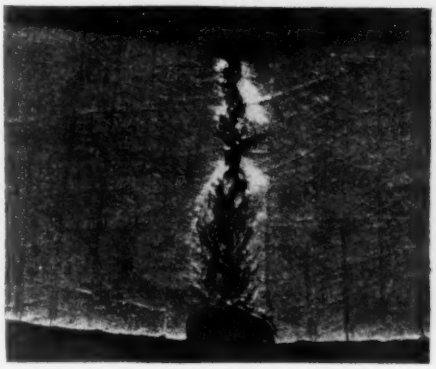
FIG. 3.

over a die 20 mm. long, with a punch-shaped tool in a machine. This machine was arranged with an autographic apparatus for producing the stress-strain diagram of the test.

"Now take the two steels which have given

approximately the same diagram by the tension test. Call these two steels No. 9 and No. 16, as in Fig. 2. Subject the same material to a bending test. The second set of curves were obtained from these two steels tested both with the rolling and at right angles to it. These curves show that in both cases No. 16 broke with a greater amount of work than No. 9, although the reverse was shown by the test of tension. Then, again, at C is a bending diagram of a steel which gave a similar tension diagram. This, as can readily be seen, gives a far better bending test than either of the other two steels.

"These bending tests reveal some quality of the steel not revealed by the tension tests. Does the bending test reveal all? Will it reveal this quality on a less ductile steel? Take a soft steel, prepare a specimen as formerly, placing a notch at its under side to reduce the elongation, then polish one side and submit it to a partial bending. The deformations



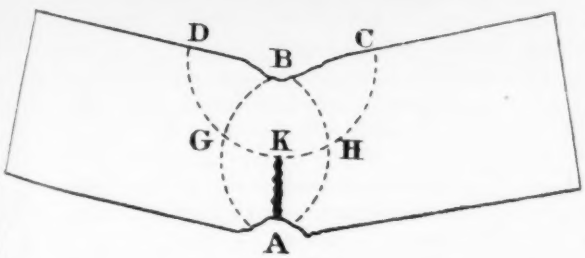


FIG. 4.

are easily seen in Fig. 3. They consist of the interposition of two elementary deformations more distinctly shown in the diagram. One deformation is that of swelling; the other that of depression. The depression E F G B H is nearly an ellipse, of which the major axis coincides with the line A B joining the point of impact to the notch. The swelling is a portion of the ellipse having the same major axis as the preceding, but the extremities of the major axes do not coincide. The two ellipses

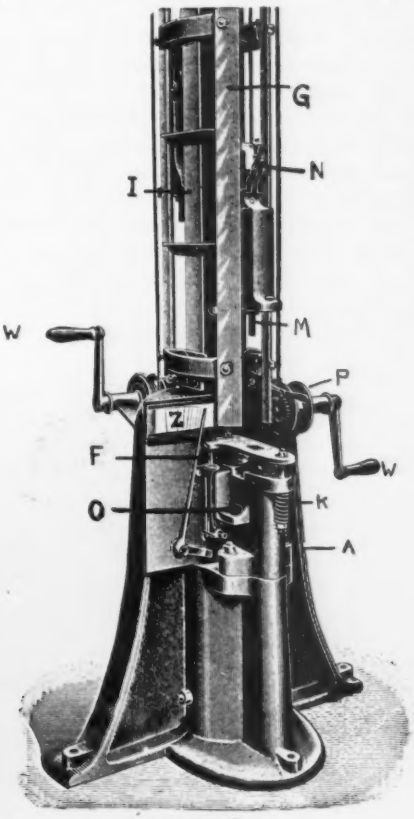


FIG. 6.

have the part A G B H in common, and thus the two deformations are in part neutralized. The other portion of the ellipse produces the maximum deformations, and the rupture takes place along the synclinal lines.

"Take now the case of a fragile steel as shown in Fig. 4. In this case the ellipse caused by the compression or the swelling is reduced to nearly nothing. The rupture is made downward by tension following the line A K in the diagram, and the rupture is effected abruptly with a very small expense of work. For steels of intermediate quality, the two ellipses will vary from one extreme to the other. The rupture of these steels depends upon the position of the point K of the ellipse compression. If the point K goes to A the metal will not be weak, while if the point K rests in the neighborhood of point B, the metal will be extremely weak. Thus both the prominence of the swelling and the position of the point K are important factors in this determination for the fragility.

"Here again in connection with these deformations Mr. Fremont states that in the period of permanent deformations the neutral surface is neither parallel to the faces nor at equal distances from the faces. The position of this surface may vary with the condition of the test, and, conditions being equal, with the quality of the metal; in other words, the more fragile the steel, the closer the neutral surface approaches the compressed side, and vice versa. As the neutral surface is not at equal distances from the faces, especially for fragile steels, the idea is inferred that a difference exists between the elastic limit for tension and for compression; thus Mr. Fremont, in a note to the

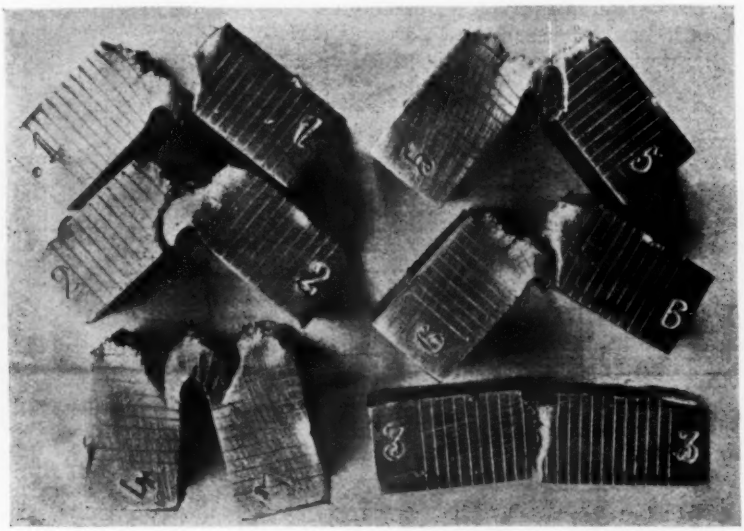


FIG. 5.

French Academy of Science, stated that 'a steel is fragile—that is to say, it breaks abruptly by bending with the expenditure of a small amount of work—or non-fragile—that is to say, it breaks only in exerting a quantity of work proportional to that exerted for rupture by tension—according to whether the ratio of the elastic limit of tension to the elastic limit of compression is less or greater than unity.' This would not be an absolute means of judging the fragility, as the elastic limits would be taken from static tests, and not by means of a blow or impact.

"It has been proposed to require all steel to stand a certain drop of a hammer, and keep this a standard. Then, however, two points for discussion would arise: 1. The possibility of an arbitrary appreciation of the commencement of rupture. 2. The total resistance of the metal could not be measured.

Let us take a slightly different form of drop testing. Take a bar and mark it off by small notches and place it under a hammer, dropping the same through successive heights, until a point is reached when an increase or decrease will rupture or prevent rupture of the bar. This gives the result only after testing a great number of bars; it also supposes the metal to be homogeneous; and finally it does not reveal accurately the fragility of the steel, because a steel breaking with an amount of work equal to N ft. lb. produced by a height of fall equal to P will break with a quantity of work less than N produced by a fall greater than P. To illustrate this, Mr. Fremont took from the same steel six specimens of the same size and marked them 1, 2, 4, 5, 6, and 3. He then tested them by shock at increasing speeds of from 1 meter to 1½ meters. These specimens so broken are shown in Fig. 5. The first five appear about the same, the sixth, or No. 3, alone being broken off abruptly. The metal had thus become fragile for a speed of 1½ meters.

"To explain this fact it is supposed that the transmission of the forces in the material is not instantaneous and so depends on the speed of impact. The volume of the metal concerned will vary inversely with the speed of impact. In the product of the resistance by the deformation, the factor 'deformation' decreases as the speed of impact increases, and the rupture

will be made with a less expenditure of work.

"The scientist Carnot in 1889 stated: 'If we suppose a steel or iron submitted to a continuous slow force, it is understood perfectly that this persistent force transmits itself successively from molecule to molecule in such a manner that all the molecules are submitted to like forces. In the contrary case, when the force is abrupt or instantaneous, it is understood that all the molecules touched can be disaggregated from the beginning, while the other molecules will support no apparent effort.' According to this, then, metals can exhibit very different qualities when submitted to a slow force or to an abrupt one.

"In tension testing the speed is a more or less important factor, depending on the ductility of the steel, and it is well known that an increase of speed increases the resistance of the metal but decreases the elongation.

"By comparing tests effected by rupturing specimens by a repetition of blows and by a single blow, Mr. Fremont found that some steels ruptured by a single blow required but one-third to one-fourth the amount of work required by the repeated blows, and thus impact testing employing a repetition of blows is little better than a bending test. Steels appearing non-fragile by the first method would appear fragile when subjected to a single drop of a hammer just sufficient to break the bar. As the shock test varies with the speed of impact and the deformations become smaller, the fragility slightly shown in the bending test will appear in its true form in the impact test.

"The rate of molecular transmission of force through a steel may be one way of defining its fragility. It is also a fact that for the same steel this rate approaches a limit independent of the speed of impact when twice that sufficient to rupture the specimen. Knowing the desirability for an accurate and easy means for shock testing, Mr. Fremont presented a communication to the Academy of Science in 1897 proposing a method of registering the amount of work required to produce rupture by this means.

"As the speed of impact is a great factor, it is necessary to make the speed of the hammer sufficiently great to rupture the specimen with one blow, whatever the quality of the metal. If the steel then proves non-fragile to a drop of this kind it has been proved non-fragile to the test of a cannon. To determine the amount of work absorbed to produce this rupture, it is necessary to measure the residual work that is possessed by the hammer after rupture of the specimen. After numerous tests by shock Mr. Fremont finished a machine embodying principles by which this residual force could be measured. First, 'crushers' were employed from which the residual force in the hammer could be measured from their known compression; this, however, was not very practical, and in the commercial machine a set of springs is used to measure this residual force.

"The machine as built today is shown in Fig. 6. The whole of the machine is 18 ft. high; the part shown is about 7 ft. This represents the lower portion. The design is made double; i. e., it is arranged so that two may operate on the same machine at the same time. The base of the machine is composed of two parts connected by bolts. Between them, and held tightly by them, is a central I-beam marked I. This carries the six cast-iron supports, at intervals, to which are bolted the four rolled steel guides marked G. Two anvils are bolted on opposite sides of the base, the whole weighing more than 1,500 lb. The weights of the hammers are 20 and 30 lb., or about 1-70 of the total weight of the machine. The anvils marked A contain in front and in back of the matrix vertical cylindrical holes serving for the lodgment of two springs. A cap of hard steel is placed directly over them. It is this cap or platform which receives the hammer after the rupture of the specimen.

"The hammer compresses the springs and the space traversed by them is then measured. As the springs rebound after the blow, it violently repels the cap, and so to offset this new shock the cap is held by two small springs, one of which is visible on the front of the anvil at K. These springs thus serve merely as a deadener to the cap when rebounding. On each side of the base and to the right of the operator is a windlass marked W, by which the hammer is easily and quickly raised. A ratchet and lever placed at P prevent the downward motion of the hammer when placing the specimen in position."

"Each hammer has inserted at its lower extremity a hardened steel punching tool, as at M. A gripping device at N holds the hammer to the pulling cord until automatically released at the top of the machine. It is also released at any point by attaching a cord near N.

"To operate the machine we first raise the weight enough to allow room to place the specimen in position, notch side down, with notch directly to the center of the die. Then

we turn the windlass, raising the weight to the top, where it is automatically released, and falling, breaks the specimen, which in turn falls through the die into the pocket at the side of the machine. Having broken the specimen, it is necessary to measure the work required to cause the rupture. The cap covering the springs pushes down a light steel tube at F, which is held by friction so as to give an accurate measurement of the deflection of the springs. This deflection is further multiplied by the aid of the instrument shown at Z.

"To calibrate the machine the hammers are raised through successively increasing intervals of height and dropped on the platen covering the springs. Corresponding marks are placed on the card of the instrument. Thus,

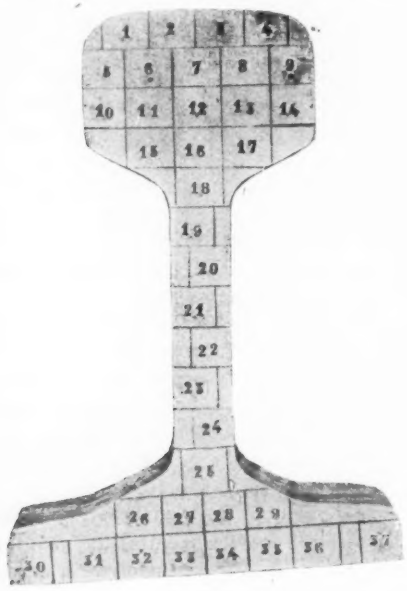


FIG. 7.

the machine can readily be calibrated at any time with about ten minutes' work.

"The method, by using small specimens, reduces the cost of test pieces and their preparation, thereby furthering the great production of tests and thus aiding in establishing a standard homogeneity test. A second advantage is that the small specimen permits of testing thin plates, both with and across the rolling, as well as the possibility of testing parings or clippings from actual material used, or those nearest to any section subjected to the greatest known stress. In the third place the machine affords an accurate method of measuring the work necessary to produce rupture under standard conditions, always maintaining the same speed of impact. The machine as manufactured in this country will have a standard drop of 13 ft. with hammers weighing 20 and 30 lb., as these are the nearest English units to that used in the metric system.

"The specimen will be ⅜ in. wide, 5-16 in. thick, and 1¼ in. long, with a saw-cut 1-16 in. deep. The die is 13-16 in. wide. The machine can be shifted from the one standard to the other without any material change. The specimens may be prepared either by hand or in quantity by a small machine constructed for the purpose.

"Fig. 7 represents the section of a rail showing the method of cutting out Fremont specimens from the entire section. Thus, any rolled form can readily be tested to determine the effect of the rolling on any portion of it. The rail after the test is shown in Fig. 8, the pieces bent having been subjected to the bending test, while those appearing broken abruptly were tested by shock.

"In testing cast iron for fragility a machine similar to that described can be used where neither the drop nor the weight of the hammer need be as great, and thus lighter springs could be used which would show smaller differences in the material. As cast iron is extremely fragile, the speed necessary for rupture need not be much greater than that necessary to produce rupture for steel, or in other words the amount of work required to produce rupture would not vary to such an extent with the speed of impact as in the case of steel. Thus, although cast iron may be tested on a machine as described, it would not be necessary on account of maintaining the same conditions of test. A smaller and cheaper machine could thus be made for such work."

Discussion.

A. E. Outerbridge Jr.: The machine is different from one with which I am familiar, where the residual force is measured in an entirely different way. I would like to ask Mr. Olsen if he tested any of those pieces on a rigid, non-yielding anvil? I understand the anvil is practically supported on springs which give at the moment of impact, and the residual force is determined by the compression of the springs?

Mr. Olsen: The specimen is not connected with the springs; that lies on the anvil itself. After the specimen is broken then the hammer falls on the plate connected with the springs.

Mr. Outerbridge: The residual force in the hammer is measured by the compression of the springs?

Mr. Olsen: Yes. I have some broken specimens which in a tension test showed the same elastic limit, ultimate strength and elongation, but when subjected to shock test broke in various manners. Some show a fibrous structure, while others show a crystalline structure. Those exhibiting the fibrous structure broke with 300 to 400 percent greater work than the crystalline structures.

Mr. Outerbridge: It may be interesting to the members if I give you a brief account of an impact testing machine which has been in use in William Sellers & Co.'s works for about ten years. It is intended for impact tests of cast iron, but I think it would be equally useful for steel. We made a great many tests of that kind and the same difference is observable in cast iron that we have heard about tonight in steel; that is to say, you may have bars of cast iron which show a very high tensile strength, and of course there is very little elongation in testing cast iron, but when you subject two pieces of cast iron (the companion bars having shown approximately the same tensile strength) to an impact test where you are able to measure the residual force remaining in the hammer after the break, you will find there is sometimes an enormous difference in resilience amounting to several hundred percent, and that is a very important matter. So far as I know, no account has ever been given of the machine I am about to describe now. We first made a machine on the same principles as the one described, which is what we called a "gallows" machine, where the weight, 14 lb., is allowed to fall from a certain height and the residual force is measured by the hammer. We subsequently modified that machine by making an improved form of hammer, somewhat like this mallet. This may represent the hammer, which was in this case 20 lb., having a steel nose put on the end; in fact, the whole hammer was a piece of steel on a rigid arm, which was supported about 3 ft. in length on ball bearings, so that the friction was reduced to the smallest possible degree. This hammer is raised to a certain point where there is a trigger that holds it. When that trigger is released the hammer falls, and if there is no intervening object to impede its force, it will, of course, swing to the full length of the arc, that point being measured by a moving pointer which travels with the hammer and remains at rest at the extreme distance, thus recording the swing of the hammer on a graduated arc. The hammer, if started, will continue to swing something like a quarter of an hour, each time the hammer going a little less far until eventually it will come to rest. It takes more than 15 minutes to come to rest, owing to the fact that the friction is reduced to a minimum by the ball bearings. Just at the vertical point there is a rigid support for cast iron test pieces. It is

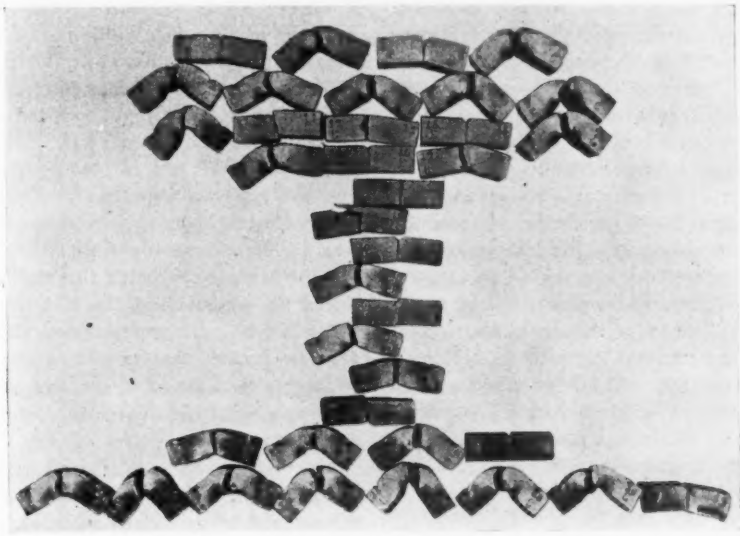


FIG. 8.

a support similar to that which we use for transverse tests of cast iron. The bar is 1 x 1 x 15 in. and put in with the supports 12 in. apart and rigidly fixed so that there is no movement. In this case there are no springs. There is alongside this test piece a pointer which is just sufficiently rigidly supported so that when you move it out to any point it will stay there—it won't fall back. The arc is graduated in inches up to the extreme end. As I say, when there is nothing interposing, the hammer will swing out to the extreme end and then come back. The pointer will be carried with the hammer and left at the extreme point to which the hammer swings. Then, if you want to measure the amount of decrease each time the hammer swings you simply move that pointer back and then the hammer carries it forward again. Of course there is a trifling resistance offered by the pointer, but it is the same in all cases, so that this is negligible. This hammer is so arranged that you break the bar on the first blow on all occasions. If you have a piece which offers very considerable resistance—take a piece of very strong cast iron for example—the resistance offered by that piece will be quite considerable, and of course the hammer will not go out so far, and the pointer will rest at the place of its extreme swing. It will never be moved by the second swing, and the moment the piece is broken it falls out of the way. We have made a large number of tests of cast iron with that machine and have many records. I am not prepared tonight to give an account of these records, but we found by that machine that there is a very much greater difference in the resistance to impact than was revealed by the transverse test machine, either from the resistance to strain or from the bending record; in other words, the ductility or resilience, or bending quality, or resistance to shock of cast iron cannot possibly be measured accurately by either the transverse or tensile tests alone. There is no measuring by compression springs whatever in this machine. It is simply the resistance given by the breaking of the metal that is recorded by the swing of the hammer.

Mr. Olsen: I believe there is a machine of that kind at the Lehigh University. In steel, where you require a certain speed of impact, which according to the Fremont method is absolutely necessary, it would be useless. If you increase the height of fall you will break the specimen with a less amount of work, so one specimen passing your test will fail when subjected to the Fremont test. If I raised my hammer up to half the height I would break the bar, but it would take a greater amount of work. If I raise it twice that height it will take a less amount of work.

Mr. Outerbridge: The same principle applies where it is a swinging hammer. It is still impact.

Mr. Evans: Is the drop of that weight the same as the impact of a cannon ball?

Mr. Olsen: The speed of the Fremont machine is equivalent to the speed of a cannon as far as the breaking of the specimen is concerned. After you reach a certain point any further increase in speed will not change the transmission of the force through the molecules. There seems to be a limit. If you get a less speed it is within the limit. The trouble with the pendulum machine is that you cannot increase the speed sufficiently for testing steels, and the specimen is not placed on a rigid anvil. You could not easily get a speed of hammer equivalent to a drop of 13 ft. That is necessary for the steel test. If you get a much lower you will get within the limit before mentioned.

Mr. Outerbridge: The first weight we made was 40 lb., and we found that that was excessive, so we reconstructed the machine and reduced the weight to 20 lb.

Mr. Olsen: If you increase the height of fall any further the amount of work required to break the bar will not decrease. There seems to be a limit where the transmission of the forces will not decrease.

Mr. Outerbridge: We found a very curious thing in connection with the cast iron drop testing machine. I had occasion to describe that in 1896 in a paper read before the American Institute of Mining Engineers. We found if we had a dozen bars of iron cast of the same size, from one ladle of iron in one mold, presumably under precisely the same conditions, by allowing this drop weight of 14 lb. to fall a height of 12 in. it would break any of the pieces; and before we had means of measuring the residual force we did not know whether that piece would have broken by a drop of the hammer of 6 in. or 12. This drop fell vertically in guides. There was no friction at all, because it fell in free space. In order to ascertain whether the fall of 12 in. was excessive—more than necessary for the break—we took one of those companion bars and raised that drop by inches, 1 in., then 2 in., 3 in., 4 in., 5 in., 6 in., 7 in., 8 in., 9 in., 10 in., 11 in., 12 in. It would naturally be supposed that the bar

would break before the hammer was raised to 12 in., because it had been subject to 11 blows at constantly increasing heights. We were surprised to find that in no case did the bar break at 12 in., whereas, in every case, if you allowed that hammer to drop from 12 in. in the first place, the bar would break. The question was, what was the cause of that difference? In a large number of experiments we showed conclusively that it was owing to the fact that each slight blow that you gave to the cast iron enabled it in a measure to relieve itself of the cooling strains, and therefore after it had been subjected to a number of blows, from a height not sufficient to break the bar, the bar was so much increased in its shock-resisting quality that it would not break. In some cases I have found that it took 20 blows from a height of 12 in. after the hammer had been allowed to fall from a lesser height several times to break the bar. These experiments are all recorded in the paper which I read before the American Institute of Mining Engineers in 1896. Everybody has known for a long time that if you strike a sharp blow on the rim of a pulley that has been cast (supposing the pulley is defective, or for some reason you want it broken up), there will be a concussion and the pulley will open so you can put a knife blade very readily in the crack. Sometimes you can put a steel wedge in the opening. It may open as much as a sixteenth of an inch; but if you strike an old pulley that has been run in the shop for a length of time—a worn-out pulley that you want to break up—and if you give it exactly the same blow, when you break it you will find there is no sudden snap and no wide crack; you could not put a piece of tissue paper in it. This marked difference is due to the fact that the cooling strains have been relieved by the mechanical action of vibration in service. Steel is an entirely different metal from cast iron and the same conditions do not exist. It might be a good thing, however, to try these tests on steel; instead of letting the hammer fall from the ultimate height, take a duplicate piece and give it 20 blows from one-half the height and then raise it by inches to the ultimate height and ascertain whether the piece will break by a blow from a height which was sufficient to break a companion piece with one blow.

Mr. Olsen: In cast iron of small dimensions I do not think, if it is shown by the repeated blow as in using large specimens, it would show up.

Mr. Evans: According to that the tumbling barrel for cleaning castings must make the castings stronger.

Mr. Outerbridge: Yes; that is true. It was formerly the rule with us that all fragile castings must be cleaned in the pickling tub, and must not go to the tumbling barrel for fear of breaking the small pulleys. Now that rule has been entirely reversed. All fragile castings are put in the tumbling barrel now.

After the adoption of a vote of thanks which was extended to Mr. Olsen for his presentation of the subject, the meeting adjourned.

New England Foundrymen's Association.

Fred F. Stockwell, Secretary, care of the Barbour-Stockwell Co., Cambridgeport, Mass.

The regular monthly meeting of the New England Foundrymen's Association was held at the Exchange Club, Boston, April 12, at 5 p. m., Vice President W. B. Snow, in the chair. Routine business was disposed of, after which the chair appointed Messrs. Henshaw, Stockwell and Fitch to serve on a committee for revising the constitution to comply with the present conditions of the association. Owing to the lateness of the hour it was voted that the discussion of the quiz questions be omitted.

After a short intermission the meeting adjourned for dinner. Following this the chairman introduced as the speaker of the evening Mr. V. A. Trundy, assistant secretary of the American Mutual Liability Insurance Co., who gave an address on "Liability Insurance."

Pittsburg Foundrymen's Association.

F. H. Zimmers, Secretary, care Union Foundry and Machine Co.

At the meeting of the Pittsburg Foundrymen's Association, held at the rooms of the Engineers' Society of Western Pennsylvania, at Pittsburg on April 3, two papers presented by David McLain, of Milwaukee, were read. One treated the production of steel castings historically, while the other was on the "Melting of Brass with Oil in Steel Furnaces." H. C. Babbitt, of the Westinghouse Electric & Mfg. Co., briefly related his experience with the use of a Tropenas converter for the production of steel castings, and H. M. Lane, editor of the *Foundry*, also addressed the meeting. In May a smoker will be given by the association, and an effort will be made to organize the foundry foremen and superintendents into an association as an adjunct of the Pittsburg association. Mr. McLain's paper on melting brass with oil in steel furnaces follows:

"While I was in charge of a crucible steel

and iron foundry some years ago, our concern wanted to make their own brass castings as they had considerable trouble in securing service—their castings being light and very intricate. I had never handled a brass shop, and began looking around for a man to take charge of it. I had been wondering where we could place the new department; and, as we had plenty of room in our foundry, decided to place the brass molders near the steel furnaces. I could not see why we could not melt brass in our furnaces, as we could regulate the flame to suit the work. I went around among my friends in the brass business, trying to find out whether I was right or wrong before I started .

"Before telling what they said, I will give you the conditions that existed in our foundry: We had six furnaces, two melting chambers to the furnace, and two pots to the chamber. At this time we operated from two to four furnaces per day, and six heats or twelve pots was the day's work, and the melter was through at from 2:30 to 3:30 o'clock, and the oil turned off for the day. We did not look for our steel pots to make more than three heats per pot, when the best of them were picked over and set to one side, and the balance thrown out. The ones we set aside we intended to use in case one of our pots burst in the furnace. Now, I figured, if we could use these old crucibles for melting brass it would be saving the price of brass pots; and if we could place the pot full of metal in the furnace after turning off our oil, that would help us greatly, as our company did not want to build a brass foundry until they were larger users than they were at this time.

"Now, this was the way it looked to me, and it looked right, but, as I said, I wanted to know what my brass friends thought. When I told them that I intended to melt with oil they told me it would not do. No, they had never used oil, but they knew it would burn the metal and so forth. They told me that it was a crazy idea to use those old pots; they would have small particles of steel in them and would spoil the metal. I had told our manager that I thought we could work it this way, and I wanted to try it before telling him it was no good. But it proved to be all right, so far as using the old pots and the oil was concerned.

"We would place our filled pot in the furnace immediately after pulling our last steel pot, and would have our metal melted in from 35 to 40 minutes. The castings gave good satisfaction, but, as we were a young and growing concern, we had to build a brass foundry, as we needed the room for our iron and steel molders, and we put in six brass furnaces of the regular type. But it demonstrated to our entire satisfaction that brass could be melted with oil in a steel furnace, both after our steel was melted and when we chose to light a furnace if we were in a hurry for some castings. It also proved that we were right in thinking that we could use those old pots. We have gotten as many as 16 heats from an old discarded steel pot—but about eleven heats were the average.

"After we started our brass foundry I had placed there one of the best men I could find to take charge of it—a studious, thorough mechanic. I advised him to see what he could do with those old pots, and he has gotten as many as 18 heats, but this is an exception. We talked the matter over and finally decided he should take a new steel pot, and see what he could get from that. Although he was afraid at first that probably the steel pot might affect the metal, and besides the steel pot was not as handy; but when he took the steel pot he cut a lip on each side to make easier pouring. We watched the castings in the machine shop and they were all right. We got 32 heats from the first pot, and, if I am not mistaken, 35 from the next, and our average was 31 heats for the first six pots."

Buffalo Foundrymen's Association.

The regular monthly meeting of the Buffalo Foundrymen's Association was held in the Builders' Exchange on Tuesday, April 18th, President Lyman P. Hubbell occupying the chair. Twenty-seven members were present and after the regular routine business the president introduced Mr. W. H. Carrier, of the Buffalo Forge Co., who presented a paper on "Air Blast for the Foundry Cupola." After some discussion of the paper, a vote of thanks was tendered Mr. Carrier and the meeting adjourned.

The Associated Foundry Foremen.

Frank C. Everitt, Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

The Associated Foundry Foremen have sent out a circular letter to foremen of the different foundries throughout the United States, calling attention to the objects of the association and asking all interested to join. The circu-

lar also calls attention to the arrangement made with *The Foundry*, by which all members of the Foundry Foremen's Association receive *The Foundry* as a part of the return for the dues which they pay. This arrangement was made with the Foundry Foremen at their request and does not signify that *The Foundry* is the official organ of the association, or that there is any closer bond than has existed in the past, but as *The Foundry* stands for the best possible foundry practice, and as the organization of the Associated Foundry Foremen stands solely for the improvement of foundry methods, it is unnecessary to say that the closest bond has existed and always will exist between this organization and *The Foundry*, and as the interests of each lie in the same field, it is but natural that each should help the other in every way possible.

In this circular letter it is stated that if application for membership is received during the year, the dues will only have to be paid for the balance of that year ending June 1, and not for the full year. The dues will then be renewed on the first of the following year. The dues for the Associated Foundry Foremen's Association are two dollars per year, payable in advance. In cities where locals exist, there is an additional payment due to the local.

Elsewhere in this issue we publish a statement concerning the headquarters of the Associated Foundry Foremen at the convention of the Associated Foundry Foremen and the American Foundrymen's Association, which is to be held in June.

Milwaukee Foundry Foremen.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

The Milwaukee Foundry Foremen met on April 3, with 28 members present. One new member was elected and the regular business transacted, after which Mr. McLain read a paper on steel casting, in which he reviewed the progress in steel foundries for the last 25 years. He also gave a talk on melting brass in a steel furnace. Copies of these same papers were read before the Pittsburg Foundrymen's Association and are printed in connection with their meeting.

The question came up for vote as to whether they should have one or two meetings a month, and it was decided that it would be the best to have one meeting a month.

Mr. Henry Beagel, of the Allis-Chalmers Co., is to read a paper at the next meeting.

BANQUET TENDERED TO THE ERIE FOUNDRY FOREMEN.

One year ago the Erie Foundry Foremen's Association tendered a banquet to the Foundrymen of Erie and on April 1st the foundrymen entertained the foundry foremen of Erie. The banquet was an affair long to be remembered for the quality of the menu, for the originality of the menu card, and for the sparkling wit displayed in the toasts and speeches. The following is taken from the menu card, showing the menu and the program.

BANQUET GIVEN IN HONOR OF THE ERIE FOUNDRY FOREMEN'S ASSOCIATION BY THE ERIE FOUNDRYMEN, AT THE REED HOUSE.

April 1, 1905.

PROGRAM.

Matthew Griswold Jr., Toastmaster.

"Why we organized the Erie Foundry Foremen's Association and the benefits resulting therefrom,".....Mr. Wm. F. Grunau.

"Good fellowship among the foundries....Mr. Chas. W. Davenport.

"The possibilities of our organization"....Mr. Jas. A. Murphy.

"Agreements and their value to the foundry".....Mr. U. P. Rossiter.

"The Ladies" (in the core room).....Mr. Harry E. Kies.

"Foundry System".....Mr. B. J. Walker.

"The 'Machine' in the foundry".....Hon. Matthew Griswold.

"Cast Iron Thoughts"...Mr. Thos. E. Durban.

MENU.

Sand cut up at 7:30 p. m.

Oyster Cocktail, high in sulphur.
Bull Ladle Consomme.
Amontillado.

Olives, well pickled. Sanded Almonds.
Celery.
Follow Boarded Shad.
Cucumbers.

Small Fillet, Mignon a la Cherron.
Punch, well annealed, a la Roman.
Hauts Sauterne. Cigarettes.
Guinea Hen, core oven roasted.

New Bermuda Potatoes, sand blasted.
Spinach, a la Francais. Pommard 1881.
Lettuce, with large header and Tomatoes, French facing.

Ice Cream, chilled. Cake. Fruit.
Roquefort Cheese, well vented.
Cafe. Water Crackers.
Moulds a la Havana (a three sprue job.)
German Brew.

A little explanation of some points of the menu will be of interest. For instance, the follow board shad was planked shad served on little follow boards. The cigarettes were passed in a hand ladle. The last item, entitled "Molds a la Havana," consisted of individual flasks served to each person. These were small flasks with follow boards all clamped up. Upon removing the clamps it was found that each box contained three excellent cigars. The pouring off then occurred.

A very good model of a regular cupola about two feet in diameter had been built at one side of the banquet room. It was connected with blast pipes and all the regular paraphernalia of the genuine article. After the blast was put on, they waited some time and then tapped the cupola, when, to use the words of the secretary, "Fluid iron (?) poured forth, covered with a white, foaming slag." The precious liquid was caught in a shank ladle and passed around to the individual workmen (?) and every one poured off his own work. It was past midnight when the bottom dropped, and even then the unusual statement was made—"Let the heat go on; we'll work after the whistle blows." All present certainly had a good time and one which they will remember for many years.

Erie Foundry Foremen.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

The regular meeting of the Erie Foundry Foremen's Association was held Monday, April 3, with President Grunau presiding. There was a large attendance and after the regular routine business, an interesting paper on "Cost Keeping in the Foundry," was read by W. F. Grunau. The members also spent some time in discussing the banquet which had been tendered them by the local foundrymen's association on April 1st.

Cleveland Foundry Foremen.

W. H. Nicholls, 608 Gordon Avenue, District Vice President.

The Cleveland Foundry Foremen are arranging for a banquet to be held May 6th, to which all of the foundrymen of Cleveland and vicinity are invited. It is expected that there will be a large attendance. Dr. Moldenke is to be present and several others will respond to toasts. The Cleveland Club of Associated Patternmaker Foremen has been asked to cooperate with the Foundry Foremen in this banquet.

PHILADELPHIA FOUNDRY FOREMEN.
W. P. Cunningham, Secretary, Pencoyd, Pa.

NEW YORK FOUNDRY FOREMEN'S ASSOCIATION.
S. M. Williams, Dist. Vice Pres., 221 Third Street, Elizabeth, N. J.

CHICAGO FOUNDRY FOREMEN.
David Spence, Dist. Vice Pres., 142 Bunker St.

INDIANAPOLIS FOUNDRY FOREMEN.
W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

HAMILTON, ONT. FOUNDRY FOREMEN'S ASSOCIATION.
A. Chase, care Sawyer & Massey Co., Secretary and Treasurer.

REVIEWS.

SCIENCE IN THE IRON FOUNDRY.

The Iron and Coal Trades Review, Feb. 24.—The famous iron master, Mr. J. E. Stead, F. R. S., F. C. S., etc., delivered an address before the Cleveland (England) Institute of Engineers recently, in which he reviewed the progress made in the foundry by the aid of science. Science in the foundry, he holds to be, "the exact knowledge of things relating thereto, which have been proved by demonstration." Only recently has the study of cast iron been taken up, and it now receives a great deal of attention. Analyses of castings vary very much, yet the first rate ones of the several classes always run within certain well defined limits. Hence it is the object of the founder to build up his mixtures to come out to these several compositions. The founder must demand pig irons from the furnaces which have uniform composition, so that his mixtures made with them will work out well. The old-time grading by fracture must now be set aside altogether, and the new order of things adopted. Back in 1885, Mr. Stead advised the mixing of two kinds of iron, one a "glazed iron," the other a white iron, both being unsalable, and predicted good gray castings from the mixture. A Mr. Wood tried it and met with perfect success. The "glazed" pig had 4.43 percent silicon. As the result of this trial, the glazed pig iron became an article much sought after, and

originated the introduction of ferro-silicons in the foundry.

Mr. Stead thinks that sulphur does not do much harm in the iron as long as it is not allowed to harden it. In other words, the silicon must be kept high where this is likely to occur. Founders who make very light castings for high speed machining are not likely to indorse this view, and will keep sulphur out at all hazards.

A founder should get a good metallurgist to care for his mixtures and general practice. He seldom finds such a man, as most chemists, while capable of determining the constituents of cast iron, are not good metallurgists. Hence there is a field for properly trained foundry metallurgists, and these men must at the present time be trained in the foundry or "made." Mr. Stead advises that a foundry metallurgist should give his employer a review of all published foundry literature regularly, in abstract form, to show that he has absorbed it, as well as to post the foundryman along this line of his business.

In the discussion which followed, Mr. Hutchinson, a furnaceman, recited his experience with the foundrymen of Germany, Austria and England. He found that they did not want iron by analysis at all, but bought by fracture grading altogether. The furnace had chemists, and sent the proper iron for the work the foundryman had to make. In America we have things different. The heavy kickers who want special fractures get beautiful ones in their metal sent them. Those who know, however, get just the composition they want, irrespective of fracture, and fare much better. They will arrive at this point in England after a while also, and Germany is fast following the American footsteps herein also.

Other foundrymen taking part in the discussion gave distinctively favorable views on the foundry laboratory. One foundryman, however, thought it would take thirty years to get the English foreman to mix his iron by analysis. He ought to take a trip to America and see how the foremen take to scientific mixing of metals here.

In reply to the questions and criticisms of his paper, Mr. Stead simply remarked that a piece of pig iron (shown by Mr. Hutchinson), which would be photographed as a frontispiece to his published paper, having a No. 1 and a No. 4 fracture on the same surface, and yet was of uniform composition, would be his best answer. Where would the practical grader come in on this?

THE MICROSTRUCTURE OF CAST IRON.

The *Ironmonger*, Feb. 25.—At a recent meeting of the Staffordshire Iron and Steel Institute, Mr. O. F. Hudson read a paper on the above subject. Cast iron, on account of its great impurity, presents more difficulties under the microscope than steel. By considering cast iron as a steel, with its graphite scattered throughout the mass in flakes, the study of this material is greatly simplified. That iron, which has the least combined carbon, or, in other words, has the mildest steel as a matrix, is necessarily the softest and easiest to machine, and the graphite forms a good lubricant for the cutting tool.

Prof. Turner, in the discussion that followed, is quoted as saying that cast iron is easy to study under the microscope, as specimens can quickly be polished and etched, and from the structure its adaptability for the purpose intended can readily be told. It is a question if Prof. Turner has not been misquoted, and that steel was meant; for all students of cast iron are eagerly awaiting the man who will make the microscope available for practical use in the foundry. So far we are quite a ways off.

The Mobile Foundry Co., of Mobile, Ala., has been incorporated with a capital of $10,000. The incorporators are: J. H. Mahler, Harry W. Ollinger and C. J. Mahler.

The Western Machine & Foundry Co., of Wichita, Kan., succeeds the Wichita Bridge & Iron Co., which was forced into the hands of a receiver about a year ago, but paid off 90 cents on the dollar and has been reorganized and placed on a firm financial basis, with Geo. Christopher, of Wichita, president, H. Anthony, vice president, and James Warren, secretary and treasurer.

Jack Goodwin, of Caldwell, Idaho, is organizing a stock company with a capital of $10,000 for the purpose of putting in a foundry and machine shop to look after local trade.

W. B. Hayes, formerly of Bradford, Pa., has recently returned from Burmah, India, where he was employed by the Burmah Oil Co. This company is operating extensive oil fields in Burmah and Simla, and in order to obviate the necessity of transferring materials to and from the fields for repairs, etc., they have installed machine shops, foundries and a general repair department in the oil fields. A number of Americans are employed with this company.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

The following experts answer questions in this department:

W. J. Keep, Cast Iron.

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

C. Vickers, Brass Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Castings for Automobile Cylinders.

The iron needed is close grained with low shrinkage and soft enough to tool with ease, as good cylinders can be made in the United States as in France. The making of cored automobile work is improving and advancing the art of molding and casting of iron more rapidly than could have been done in any other way and will have a great influence on other inventions requiring complicated and intricate cored castings.

Semi-Steel.

What is the powder that is put into the ladle to produce semi-steel? Our machine shop turns out a large amount of steel borings and turnings. To use them should we put them into wooden boxes the same as we do cast iron borings or would you put them in the ladle and tap the iron on to it?

Answer.—Semi-steel is ordinary cast iron containing from 10 to 20 percent of wrought iron or steel. The steel should be put into the cupola along with the pig iron. You can place 100 lb. of clean steel borings in a pine box and nail the cover on and charge instead of 100 lb. of pig iron. You can find by experiment how much borings you can use. It is usual to use steel scrap in larger pieces such as the planing chips or strips cut from boiler plates.

This mixture would not be fluid enough to run freely into a mold and would throw off gas which would cause the casting to be unsound. Aluminium in some form is placed in the ladle before the iron is tapped into it. Pure aluminium in chunks is by far the best with perhaps a little larger amount of granulated ferro-manganese, say one-tenth of one percent of aluminum. The granulated ferro-manganese is much better than the powder.

The base of any flux for semi-steel is aluminium.

The strength of semi-steel will be more than 20 percent greater than ordinary iron castings.

CLOSE IRON FOR CASTINGS.

We make a fairly good grade of gray iron castings, only we would like to be able to get closer grained iron and not have it too hard. Can you put us in communication with any one who could give us information for using aluminium by applying it in the molten metal to give the above effect, or how should it be applied? What is carbonese used for in connection with the molding trade?

Answer.—Softness will depend upon the percentage of silicon in the iron, therefore, you must first find how much you need and then get it into the mixture. You can purchase pig irons that contain the right amount of silicon or you can use some pig containing too much and other pig with too little, making the average correct.

This decided, the closer the grain of the pig iron the closer the grain of the castings, or you can introduce a liberal amount of machinery scrap, which always has a close grain. Stove plate scrap has a very close grain and is expected to contain about 2.75 percent of silicon.

Aluminium placed in the ladle will soften the iron slightly and will produce sound castings. Purchase commercially pure aluminium but never the cheaper casting aluminium. Use about one-tenth of one percent or less and it will instantly mix through the molten iron and remove gases and make solid, strong castings.

Carbonese is a trade name for a flux composed wholly or nearly so of ferro-manganese. The latter can be purchased in lumps and placed in the cupola and melted along with the iron or can be purchased in a granulated form, when it is placed in the ladle and the melted iron falls upon it. If you cannot purchase granulated ferro-manganese in small quantities you had better use carbonese. It removes sulphur and removes gases and in that way makes sound castings. Some like it and some do not.

By keeping the silicon high enough to make the castings soft you can get the required grain by a careful selection of close grained pig irons and scrap without the addition of any medicine. You will generally find that the close grained irons have low silicon. Using such irons and increasing the silicon by the

use of a six or eight-percent silvery iron will give you closer grained castings than a mixture of pig irons, each of which contains the silicon needed in the casting.

BRASS FOUNDRY NOTES.

BY C. VICKERS.

RECOVERY OF BRASS FROM SLAG.

Inquiry.—Kindly let us know what we can put into the slag that forms in our brass crucibles that will enable us to melt this brass or slag and recover the brass which it contains.

Answer.—The accumulation of slag on the walls of a crucible can be largely prevented by careful attention on the part of the furnaceman. After every heat the walls of crucible should be scraped with a long chisel pointed bar.

A slagged crucible is very expensive, as it takes longer to melt the brass, the slag being a non-conductor, prevents the passage of heat through the walls of the crucible, and also greatly diminishes its capacity.

Cleaning the crucible while hot will greatly help to prevent slagging, but in spite of this it will form and become so hard that the bar will not detach it, without danger of breaking the pot. In that case place the crucible in the furnace after the first heat is out and the furnace is well heated. Coke up the crucible but do not charge it; let it become white hot, then the slag can be all scraped from the wall of pot with a poker while it is still in the fire, then throw a little charcoal on the slag to reduce it and proceed with the heat as usual. Some founders try to remove the slag when the pot is cold. This is a tedious job and injurious to the crucibles.

The precautions above stated will keep the crucible fairly clean, but a worn out crucible will generally have some slag sticking to the walls. Break up the crucible, detach the slag, and pound it up, mix with fine charcoal and place the whole in the bottom of the new crucible taking the place of the old one; the charcoal will reduce the oxide to metal. Never allow slag to accumulate, never keep old pots, but let every new pot succeed to the slag from its predecessor. But if there is a pile of slag on hand, pound it, mix with charcoal and proportion amongst the heats until used up.

C. VICKERS.

COMPOSITION METAL.

Inquiry. In the United States and Canada there is a composition very largely used which is approximately a whiter mixture than brass and also cheaper. It is a recognized metal and usually sold nickel plated. It is sometimes called electro nickel on compo. Could you give us the composition of this metal, that is, the compo?

Answer. White alloys may be divided into three distinct classes, viz:—First, the alloys of copper, with nickel and zinc, known as German silver, nickel bronze, etc. Second, the soft white metals, consisting of tin with copper and antimony, or, lead and tin, lead and antimony and so forth.

These alloys are known under the names of "Brittannia," "pewter," "babbitt," "white-metal," "stereotype metal," "antimonial lead," and so forth, percentages of zinc are also often carried by the soft white metals; and third, the white brasses, in which zinc predominates. In these alloys, copper, iron, tin, etc., are added to the zinc, to change its crystalline nature. Any white alloy which resembles brass in that it is harder, and more infusible than the soft white metals, and is at the same time cheaper than brass, belongs to this third class, and contains zinc as its base, because if it was a brass whitened by nickel, its cost would be greater than ordinary brass or bronze, therefore the composition alluded to by this correspondent must belong to this class.

A few examples of these alloys are given:

Decoration Metal.

1. Yellow brass, 15 lb.; melt, add gradually, zinc, 75 lb.; aluminium, 3 lb.
2. Yellow brass, 15 lb.; zinc, 75 lb.; tin, 10 lb.
3. Yellow brass, 15 lb.; zinc, 80 lb.; iron, 2 lb.

Melt the yellow brass first, add zinc gradually, then the iron in the form of cast iron borings, or in the shape of ferro-zinc.

Harder alloys are:

1. Copper, 40 lb.; zinc, 60 lb.
2. Yellow brass clippings, 50 lb.; zinc, 40 lb.

Note—Great care must be exercised while melting not to burn the zinc away by overheating.

C. VICKERS.

The Pendleton Iron Works, Pendleton, Ore., successor to May & Zeiger, have elected the following officers: Marion Jacks, president; Fremont Arnold, secretary and treasurer; and W. L. Zeiger, manager.

MALLEABLE CAST IRON NOTES.

BY DR. RICHARD MOLDENKE.

SELLING PRICE AND COMPOSITION OF MALLEABLE CASTINGS.

M. E., of Montreal, P. Q., writes asking what kind of malleable castings were meant when in the March number of *The Foundry*, page 31, it was stated that in America we were selling them from 2.2 to 3 cents per lb. In reply we would say that at the time the March *Foundry* was issued malleable castings for car purposes, which are admittedly among the best made, so far as quality, but not good looks, are concerned, were selling for 2.15 up to 2.25 cents a lb. delivered. We know of cases where some malleable works, to fill up, were taking this work for a shade over 2 cents, and thereby selling at cost, if not under. Today the price has gone up to 2.50 to 3 cents, and it should be still higher, and will be after the concerns with porcine proclivities have filled up. As this class of castings comprises over 50 percent of all the malleables made, the price is a fair criterion for the rest of the industry. The smaller the casting, of course, the higher the price. Those above referred to ran from a few ounces to 50 lb., the average for the orders taken being some 6 lb. apiece.

M. E. further asks what the average analysis of the pig irons in America used for malleable purposes may be. Here it is. Silicon 0.75 to 1.50, for very light work, up to 2.00; manganese preferably below 0.60, though sometimes it runs higher, and then simply has to be burned out to prevent trouble in the anneal. Phosphorus, below 0.200, though for charcoal irons it may run up to 0.225; sulphur not over 0.04; total carbon immaterial, though it runs from 3.50 up to 4.15. These figures are for the best quality malleable. If the sulphur is exceeded corresponding detriment will follow.

Good foundry practice demands good foremen. To keep good your foreman must keep learning. This means attend the American Foundrymen's Association Convention, New York City, June 6th, 7th, and 8th.

FLUOR SPAR.

BY R. C. HILLS.

There has been much criticism of late upon the use of fluor spar for foundry purposes. Undoubtedly its value in this line has been somewhat exaggerated.

We find on looking into the use of this flux in the foundry line that possibly many of the users of fluor spar are not aware that one of the most valuable methods of using this article is by putting a small quantity in the bottom of the ladle, then drawing the molten iron upon it, thus facilitating the mixing of the flux with the metal.

I, personally, have made several experiments which have brought about satisfactory results. For instance, one of my tests in gray iron was to put in the bottom of the ladle 3 percent of ground fluor spar, drawing the molten iron upon it. By the time the molder had reached the mold with the ladle, the excess slag was quite apparent, rising to the surface and forming a heavy mass, which he stirred a half minute in order to be sure of a perfect mixture and then skimmed off. This shows the powerful action of this material upon iron. We poured two test bars from this ladle. We also poured two bars from the regular iron. These bars, when broken by a breaking test machine, showed that the bars in which the flux was used showed 11 percent greater breaking strain.

In malleable iron, the test was even more interesting. I sent four regulation rods, two with and two without the flux, to a university that professed to be very much interested in this line of work, and upon which I knew I could depend for a fair test. In fact, nothing was known about the material which was being tested. The report received from them showed in round numbers an increase from 55,000 lb. tensile strength, to 60,000 lb., and an increase in elongation from 4 to 5 percent; this, of course, proving the superior malleability of the bars in which the flux was used. I sent some of this material to a firm who are making frogs. They reported satisfactory results. At the time I sent this, I knew nothing of their trouble, but they told me that it prevented, to a large extent, cracking, with which they had had a great deal of trouble. My own experiments so far have met with the same success.

I have also made some experiments with fluor spar in brass; it has increased the strength of the metal and given better results in the finished casting.

You have noticed in the above that I have given no chemical analysis; the reason for this is that I consider the results will speak for themselves, but I have one or two analyses which prove the average betterment in prac-

tical tests, showing from 10 to 12 percent general improvement. This flux seems to leave no impurity untouched, but reduces them all; and the strangest part of it is that experiments show that the reductions are in proportion, that is, not reducing the percent of one impurity more than another, thus when you have used this flux you have not changed the nature of your casting, but have made a general betterment, which, in the majority of cases, will not injure the casting for the purpose intended, making gray iron softer, but still holding its wearing power, making malleable iron more malleable, but increasing its tensile strength.

Then we laid off the pockets and cut the slots for the loose blocks, as shown at O. The sides were then made with the edge the same radius as the outside of the print, the ends being put on the same angle as the pockets. On account of the blocks being beveled it was necessary to cut holes through the one side and pull the blocks out before taking out the core; further it was necessary to dowel the one side, as shown, on account of the sides having a bevel to form the top and bottom of the pockets, as shown at C. There is another advantage in having the one side loose and that is so the core can be turned out on the straight side.

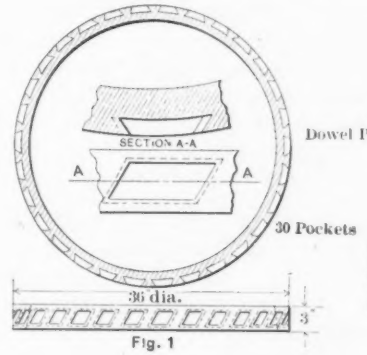


Fig. 1

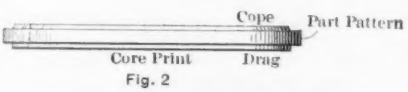
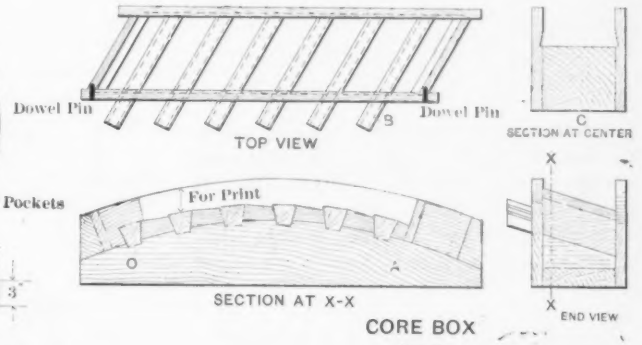


Fig. 2



CORE BOX
Fig. 3

LARGE PISTON RING.

BY S. M. RENKIN.

Recently we had a large piston ring to make and while the pattern and core box are very simple when explained, I do not think any patternmaker would make them without a little study.

Fig. 1 shows two views of the ring, also enlarged sections. Fig. 2 shows how we turned the pattern after building it in the regular way, of segments. You will notice how we made the pattern solid and let the core print run all the way around the same depth as the pockets, giving the part of the pattern from the print up plenty of draft so it could be lifted off in the cope.

Fig. 3 shows three views of the core box. First we made the block A, the radius of the top of it being the radius at the bottom of the pockets in the ring, and then laid off the length which we made just one-sixth. This can be made either one-sixth or one-eighth, the length depending entirely on the size of the ring. It should be made so it can be handled easily.

NEW BOOKS.

"Smoke Prevention and Fuel Economy," by Booth and Kershaw, published by the Norman W. Henley Publishing Co., New York, N. Y., price $2.50. While this book is written from an English standpoint, it is certainly of very great interest to both English and American engineers and to all interested in the prevention of smoke.

It deals first with the subject in a general way in the introductory chapter, and then has one or two pages on domestic smoke. This is followed by a consideration of the chemistry of combustion. Next there is a chapter on present methods of burning fuels and their defects, and in this the writer takes up not only boiler furnaces, but crucible and other styles of furnaces used for metallurgical work. The advantages and disadvantages of the different styles of boiler furnaces are very carefully considered, and it may be said that the authors condemn some of our American practices very severely, and, judging from the amount of smoke coming from some of our

chimneys, we cannot but feel that the condemnation is warranted.

In another chapter improved methods of burning fuel are considered and compared, both for boiler firing and for furnaces for metallurgical work. The fifth chapter is devoted to the examination of gases, and sets forth the various methods commonly used for taking and testing samples, both for snap samples and for continuous sampling.

There is an appendix of over 40 pages dealing with patent abstracts, including American, English and foreign patents. The appendix also contains useful tables. The book is very well indexed, and is written in a clear, concise manner, which makes it exceedingly interesting reading. All who have anything to do with the burning of fuel will certainly be profited by reading this work.

The American Foundrymen's Association, with its affiliated Foundry Foremen and Foremen Patternmaker Sections, stands simply for good foundry practice. It never has had anything to do with labor questions. Convention at New York, June 6, 7 and 8th.

REMOVAL OF AMERICAN STEEL FOUNDRIES.

The executive officers of the American Steel Foundries until lately were located at No. 74 Broadway. With the object of concentrating all of the departments of this well known concern it was found necessary to lease the entire eleventh floor of the recently completed building known as No. 42 Broadway, and henceforward communications should be sent to this new address.

It is well known that in the new movement toward consolidation of allied industries one of the chief elements of success involved the systematizing and harmonizing of every branch of the business. With this end in view the executive officers of the American Steel Foundries are inaugurating, simultaneously with the removal, a new system of accounting and distribution of orders, which will improve the organization and simplify their work. This will assist them in taking care of the many large orders they are receiving due to the increased demand for new equipment by the railroads and other large producers. The output of their eight plants for all kinds of steel castings is enormous, and they are always in a position to undertake new work and make prompt deliveries. With the acquisition of the Simplex Railway Appliance Company they are even better equipped than ever to fill the requirements of railroad companies and car builders.

SUMMER SCHOOL FOR ARTISANS.

A summer school for artisans under the direction of the College of Engineering of the University of Wisconsin will begin June 26 and continue for six weeks. The principal subjects are as follows: Steam engines and boilers, electricity, materials for construction, fuels and lubrication, and shop work. Under the latter heading they will take up the use of tools, both in wood and metal, and such subjects as blacksmithing, patternmaking, etc. The work is very similar to the ordinary shop work of the college, except that a greater proportion of time is given to the practical problems. The requirements for admission do not extend beyond a working knowledge of English and arithmetic. Students taking correspondence courses in engineering have found the Summer School for Artisans extremely useful, as a place in which they could obtain experience along the lines concerning which they had been studying.

PRIZE OFFER.

The Engineering News Publishing Co., of 220 Broadway, New York, N. Y., have offered two prizes amounting to $350, for the two best papers on "The Manufacture of Concrete Blocks and Their Use in Building Construction." The subject of concrete construction is of interest to all classes of manufacturers. This is certainly a worthy offer on the part of The Engineering News Publishing Co., and should result in bringing out some valuable literature on this new and interesting subject.

CASTING IN BRASS MOLDS.

A writer in the *Manufacturing Jeweler*, of Providence, R. I., states that for casting soft metals in brass molds, it is necessary first to have a good groove cut in the molds for a vent for the escape of the gas and air, and second, that the molds must be blued, this being accomplished by dipping the mold in sulphuric acid and then placing it on a gas stove until it is a dark blue color. Without this bluing, it is impossible to obtain a sharp casting. We should like to hear from others upon the subject of casting soft metals in brass and bronze molds.

TRADE PUBLICATION.

The April number of *Graphite*, published by the Jos. Dixon Crucible Co., of Jersey City, N. J., is a special issue in which they illustrate a large number of structures which have been painted with Dixon's paints. They also give considerable information concerning the use of paints for protecting structures. This is certainly a subject in which all foundrymen are interested, and the Dixon Co. informs us that they will be glad to send a copy to any one desiring the same.

The C. W. Hunt Co., of West New Brighton, N. Y., have gotten out a catalogue entitled "The Hunt Noiseless Conveyor." In this catalogue they describe machinery intended primarily for the handling of coal and similar materials. There seems to be no reason why it would not be equally efficient for materials about a large foundry. The catalogue is very fully illustrated.

The Double Friction Coil Clutch Co., of 207-42 River street, Chicago, Ill., has recently brought out a new device for joining shafts for power transmission. It consists of a specially designed clutch containing a double friction coil capable of transmitting a very large amount of power at either high or low speeds. The company is sending out a neat little catalogue 3½ x 6 in., describing its device very fully.

REVOLVING BRUSHES.

BY H. KAROW.

In an article by Oscar Leyde on the cleaning of castings, the subject is very nicely explained, but the revolving brush is not mentioned. The revolving brush, mounted upon an emery wheel stand, is in my estimation the best thing for cleaning between the teeth of gears and in similar cases. Our gears were formerly cleaned with the hand scratch brush and file, but it was a very slow job, when the results were compared with the revolving brush driven by power. There are different grades of brushes obtainable, some stiffer, others softer.

Such brushes are especially useful for cleaning castings intended for patterns. In fact, by using a medium or fine brush, good castings can be cleaned and polished so well that they will require no subsequent scraping or filing. I believe that after any foundryman has once used a revolving brush he will never be without it again.

Good Fellowship,
Good Papers on Foundry Subjects,
Good for Your Own Business,
The American Foundrymen's Association Convention, New York, June 6th, 7th and 8th.

PERSONALS.

Mr. James Wilson has just returned to Buffalo, N. Y., after an absence of four years in England in the interest of the New York Car Wheel Works, of Buffalo, N. Y. During this time the British Griffin Co., of Barrow-in-Furness, England, has been put in operation and a very prosperous business built up in chilled wheels and castings.

Mr. Wm. McGrail has resigned the foremanship of the Allen Fire Supply Co., to accept the foremanship of the Textile Machinery Co.'s brass foundry at Providence, R. I.

Lewis B. Reed, Omaha, Neb., who after graduating from Harvard University, two years ago, entered the employ of the American Radiator Co., Chicago, has been placed in charge of the European business of that company. He sailed on Mar. 29, and will make his headquarters in London.

Mr. Isaac Taylor, formerly foreman of the Textile Machine Brass Works foundry of Providence, R. I., has accepted a position as foreman of the Allen Fire Supply Co., of Providence, R. I.

Mr. Chas. A. G. Winther has resigned his position as general superintendent of the Chapman Valve Mfg. Co., of Indian Orchard, Mass.

Wm. T. Nicholson Jr. has accepted a position as New England agent for the Waterbury Crucible Co., of Waterbury, Conn., with headquarters at Providence, R. I.

Mr. David McLain, of Milwaukee, Wis., has gone over to Madison, Wis., to take the place of superintendent of the Gisholt Machine Co.'s foundry.

Mr. H. B. Abbot, formerly manager of the Terrell Iron Works, Terrell, Texas, has accepted a position as manager of the Greenville Foundry & Machine Works, Greenville, Texas.

DEATHS.

James McQuiston, aged 76, died at his home in Pittsburg on April 11. Mr. McQuiston spent several years with the Atlas Foundry Co., after which, in 1870, he established the Pittsburg Galvanizing Works, of which he was the proprietor at the time of his death.

Henry Hanna, a wealthy and honored citizen of Cincinnati, died at his home Mar. 27. Age 93 years. Mr. Hanna was a heavy stockholder in many business enterprises, including the Newport Iron & Steel Works, the Addyston Pipe Foundry and a number of banks. He was actively engaged in business until about a year ago.

Moses Atwood, vice president and general manager of the Pittsburg Valve, Foundry & Construction Co., died at his home in Allegheny Mar. 18. Mr. Atwood was 57 years old and had been connected with various industries in and about Pittsburg. He was active in the business enterprises which resulted in the merging of several companies to form the Pittsburg Valve, Foundry & Construction Co. in 1900.

FIRES.

The Bowler Foundry Co., of Cleveland, O., was damaged by fire to the extent of $2,000 on Mar. 29. The fire is said to have been caused by the overheating of a journal box on one of the shafts.

The plant of the Star Iron & Foundry Co., of Montreal, Canada, was destroyed by fire on Mar. 27. The fire also destroyed a number of adjacent buildings.

The steel department of the Youngstown Foundry & Machine Co., of Youngstown, O., was destroyed by fire on Mar. 19. The loss is $20,000, partially covered by insurance.

The foundry and machine shops of the Stroh-Morris Foundry & Machine Co., Charleston, W. Va., were destroyed by fire Mar. 16. Loss, $25,000.

The foundry of the American Foundry Co., of Toledo, O., was damaged to the extent of $5,000 by fire on Mar. 29. The loss is covered by insurance and the plant will be rebuilt at once.

The Fisher Machine Works, of Leavenworth, Kan., were destroyed by fire on April 6. Valuable machinery and patterns were destroyed, including some new machinery ready for shipment.

The foundry of Emrick Bros., Hastings, Neb., was damaged by fire to the extent of $2,500 on April 15. The loss is practically covered by insurance.

NEW CONSTRUCTION.

The Norwood Engineering Co., Florence, Mass., will soon erect two additional buildings, one 130 x 70 ft., and one 40 x 30 ft. It will also build an addition to the foundry, 70 x 60 ft.

The Weir Stove Co., Taunton, Mass., will build an addition to its molding shop and a building to increase the company's capacity for mounting and storing castings.

The Westinghouse Machine Co., Pittsburg, in the summer of 1903 laid foundations at Attica, N. Y., for a plant for the manufacture of stokers. The foundations were entirely of concrete and were laid for four buildings besides the office building, consisting of a machine shop 250 x 150 ft., a foundry 60 x 500 ft., a pattern shop 35 x 250 ft. and a power house 30 x 100 ft. When the preliminary work was completed, in 1903, it was the intention of the company to construct the buildings the following year; but owing to a general depression in business this plan was not carried out. It is now announced that at an early day work will be begun and the construction of the buildings will be completed.

The new brass foundry of the Consolidated Car Heating Co., of Albany, N. Y., is nearly completed. The old foundry is being demolished.

The American Steel Foundries Co. have announced that they will spend $65,000 on their Sharon, Pa., plant.

The Pittsburg Malleable Iron Co., of Pittsburg, Pa., has taken out a permit for an iron clad foundry building to cost $4,000.

The American Pulley Co., 29th and Bristol streets, Philadelphia, Pa., will build an addition to its plant, 50 x 150 ft., one story.

The Globe Foundry Co., Johnstown, Pa., will double the capacity of its plant by an addition which will cover an area of about 5,000 sq. ft.

The Bromell, Schmidt & Stacey Co., York, Pa., has added a large boiler shop to its plant. The old shop has been converted into a foundry annex, which makes the foundry three times as large as it originally was. The foundry will be rebuilt.

W. M. Currier, B. E. Taylor and Ralph Lloyd will build a machine shop and foundry at Coudersport, Pa. The building will be 210 x 136 ft.

The Stacey Mfg. Co., Elmwood Place, Hamilton Co., O., has built a new plant at Elmwood Place, which is a suburb of Cincinnati. The main building is 150 x 510 ft. The power house is a separate building, 50 x 65 ft. The general offices are on the second floor of the main building. The new plant is equipped with

the most modern machinery and appliances, including two ten-ton electric traveling cranes having a 65-ft. span. The company employs from 150 to 200 men. The foundry and cast iron departments are still located at Cincinnati, but the company proposes to erect another building either this summer or fall, on the east side of the main building at Elmwood Place, to take care of these departments.

The Columbus Pneumatic Tool Co., Columbus, O., is now located in its new plant and has largely increased its output, having been greatly overcrowded with orders at the old plant. The company owns the entire square in which the plant is situated, and some time in the near future expects to establish a large foundry in connection with the present works. The present foundry department is a small one, having been established as an experiment, but it has proved so successful that arrangements will be made for erecting a much larger one.

The Best Foundry Co., Cleveland, O., recently incorporated, will erect a foundry at Bedford, near that city. The main building will be 180 x 400 ft.; finishing department, 50 x 275 ft., and pattern storage building, 40 x 40 ft. Plans have been prepared by Kaltenbach & Griess, Cleveland.

The American Foundry Co., Toledo, O., whose plant was recently destroyed by fire, will rebuild on a larger scale.

The Day-Ward Foundry Co., of Warren, O., has replaced the foundry which was destroyed by fire last year with a new building, which has just been completed. The new building is 80 by 200 ft. and of brick and steel construction. It is fitted with a 5-ton Pawling & Harnischfeger electric crane.

Work has been started on the plant of the Stark Foundry Co., at Canton, O. The owners hope to have the plant completed by the first of June. The structure will be 50 by 100 ft. They expect to do a general jobbing business in gray iron castings.

The Favorite Stove & Range Co., of Piqua, O., is making quite extensive additions to its plant, including an addition to the foundry, which is 20 by 70 ft.

The Conway Stove Co., Toledo, O., has decided upon Fremont, O., for its permanent location, and will begin at once the erection of a brick building 700 x 80 ft.

The Hamilton Foundry & Machine Co., of Hamilton, O., is making extensive additions to its plant.

Ground has been broken at New Castle, Ind., for the erection of a new plant by B. F. Allen & Son. They will manufacture brass and iron castings.

The Wayne Stove Co., Fort Wayne, Ind., recently incorporated with a capital stock of $50,000, has not yet decided whether it will build this year. The company has received offers of buildings and land in several cities, but has not as yet accepted any of the offers.

The Barcus Horse Stock Mfg. Co., of Wabash, Ind., whose plant was recently destroyed by fire, have let a contract for a new stone building 60 x 126 ft. to replace the building destroyed.

The Home Stove Works, Rockwell street and 18th place, Chicago, will build a three-story structure mill construction, 56 x 125 ft., to be used as a shop and warehouse combined. Part of the plant will be used as a mounting shop and japanning department for piano plates.

Plans are being prepared for enlarging the plant of the Oregon Foundry & Machine Co., Oregon, Ill. The company is doing a prosperous business.

F. W. Reese, of Paris, Ill., is constructing an addition to his foundry.

The recent fire at the plant of the Lakeside Malleable Castings Co., Racine, Wis., destroyed the foundry and core room completely, but left the other buildings untouched. A new foundry and core room will be built, and will be about 25 percent larger than the old buildings.

The Valley Iron Works Co., Appleton, Wis., is building an addition to its brick foundry and installing a traveling crane, which is being built by Pawling & Harneschfeger, Milwaukee, which will be running in about three weeks. Plans for additional machinery are not yet completed.

The Malleable Iron Works, Waukesha, Wis., are being improved and some additions are being made, including two annealing ovens.

The Marshall Furnace Co., Marshall, Mich., is erecting an addition to its foundry, 30 x 45 ft.

Work on the new office and manufacturing buildings of the Aldine Grate & Mantel Co., Grand Rapids, Mich., will be begun this month. The foundry will be 50 x 100 ft. The factory for wood and iron working will be 50 x 125 ft.

The West Allis Malleable Iron & Chain Belt Co., West Allis, Milwaukee, will build an addition to its foundry, which will be 70 x 220 ft. An addition 64 x 70 ft., two stories, to the machine shop is also arranged for. The addi-

tions will double the capacity of the plant.

Loeffelholz & Co., Milwaukee, Wis., are planning to build a new foundry, which will be of frame with hollow tile composition roof, to cost $3,000.

The foundry extension of the Brown-Corliss Engine Co., of Corliss, Wis., is being very rapidly pushed toward completion. The company is now working night and day.

John Elliott, of Faribault, Minn., has announced that he will build a new foundry and machine shop in Northfield, Minn., the building to be 46 x 48 feet, and to be in operation about May 1st.

The first building to be erected by the Otto Gas Engine Works at its new plant in Wilmington, Del., will be 175 x 500 ft. Negotiations are pending to erect a large foundry on the land already purchased by the Otto Company. The foundry is an independent concern but will do work for the Otto Company.

The Fort Payne Stove & Foundry Co., Fort Payne, Ala., has decided to rebuild its plant which was burned some time ago. Work will be begun at once.

The foundry of the Hardie-Tynes Machine & Foundry Co., of Birmingham, Ala., which was recently destroyed by fire, will be rebuilt as quickly as possible.

Ground was broken a few days ago for the erection of the new plant of the Southern Skein & Foundry Co., at Chattanooga, Tenn. Wagon skeins will be the principal product. About 150 men will be employed.

The contract for the erection of the main buildings of the Coosa Pipe & Foundry Co., of Gadsden, Ala., has been let by the general manager, M. W. Bush, to T. F. Marlow. The main building will be 175 by 250 ft., in addition to which there will be several smaller buildings.

The Johannigman Foundry Co., of Covington, Ky., were forced to remove from their old position on account of the fact that it was purchased by the railroad, and they have secured a new site on which they will erect a new $35,000 foundry.

The Tuscaloosa Foundry & Machine Co., Tuscaloosa, Ala., has completed its new foundry, 50 x 70 ft., and will build a machine shop, 30 x 80 ft. The company will do a general foundry and machine business.

The Fulton Foundry & Machine Works, Atlanta, Ga., are preparing plans for the proposed foundry and machine shop buildings to be erected on the site recently purchased.

The High Point Pipe & Foundry Co., recently incorporated with a capital of $100,000, will build a plant at High Point, N. C., to have a daily output of from 10 to 12 tons of pipe. The officers are: President, J. Q. Adams; vice president, E. M. Armfield, and secretary-treasurer, O. N. Richardson.

The Swege Foundry Co., Covington, Ky., will rebuild its plant which was recently burned.

The plant of the Davis Foundry & Machine Works, Rome, Ga., recently destroyed by fire, will be rebuilt. The capacity is to be doubled.

Golden's Foundry & Machine Co., of Columbus, Ga., is erecting a new foundry, 100 by 250 ft.

It is stated that the pipe foundry of the Minnequa plant of the Colorado Fuel & Iron Co., at Pueblo, Col., will be enlarged at some time in the near future.

Mr. John McKinney expects to have his new foundry at Woodburn, Ore., in operation by the latter part of May.

It is reported that the Dickson Car Wheel Co., Houston, Tex., is planning to construct an iron foundry on the site recently purchased by them.

The Hart-Parr Co., Charles City, Ia., will build an addition to its main building, 85 x 185 ft., and will extend the foundry by an addition 60 x 75 ft. The capacity of the plant will be nearly doubled.

The York Foundry Co., of York, Neb., is building additions to both its foundry and machine shop.

Work on the new building of the Swab Foundry Co., of Elizabethville, Pa., is being pushed as rapidly as possible.

The National Foundry, Mfg. & Supply Co., Williamsport, Pa., has nearly completed an addition 30 x 48 ft.

Geo. W. Beard & Co., contractors, are pushing the work on the new plant of the Reading Stove Works, at Reading, Pa., as rapidly as possible and expect to have the additions completed in a few weeks.

The C. O. Bartlett & Snow Co., of Cleveland, O., whose plant was partially destroyed by fire on April 11, resulting in a loss of $60,000, immediately began repairs for reconstruction, and will be able to complete contracts and fill orders with little delay. It can now fill small orders from stock which was not damaged.

The Toledo Stove & Range Co., Toledo, O., has let the contracts for additions, 167 x 75 ft., three stories.

A foundry building, 67 x 127 ft., is being added to the plant of Ames & Frost, bicycle sundry manufacturers. M. J. Moorehouse, Fisher building, Chicago, is the architect.

The Monarch Coupler Co., Detroit, Mich., is preparing to erect in Delray, near Detroit, a large plant for the manufacture of steel castings in addition to couplers. As soon as the structural steel can be obtained the erecting will be commenced. The capital of the Monarch Coupler Co., which is $100,000, will be increased to $250,000 or $300,000. The new buildings will be erected on the land owned by the McMillan interests back of the plant of the Michigan Malleable Iron Works. The officers of the Monarch Coupler Co. are: President, W. C. McMillan; vice president, T. H. Simpson; treasurer, George M. Black; manager, W. C. McMahon.

The Falk Mfg. Co., of Milwaukee, Wis., are planning to spend $150,000 in erecting works upon the land recently acquired by them. The principal addition will be a large foundry.

GENERAL INDUSTRIAL NOTES.

The Huntsville Foundry & Machine Co., Huntsville, Ontario, recently incorporated, is unlike some enterprises which do a great deal of talking and obtain a charter before operations are commenced. This company had its buildings erected and some casts run off in the foundry, and considerable machine work done, before the charter was granted. There are five members of the company, who provide the capital stock of $20,000. F. H. Tool, the general manager, has been connected with large firms in Ontario and Vancouver. A. C. Suttaby is superintendent of machine shops and T. D. Moarse superintendent of the molding shops. The officers are: President, J. H. Johnson; manager, F. H. Tool; secretary-treasurer, D. M. Grant. Huntsville is a town of 3,500 inhabitants, on the main branch line of the Grand Trunk Railroad, and has not heretofore had a foundry or machine shop. The company considers its prospects for success excellent.

The C. F. Sutton Co., of Toledo, O., are to erect a plant for manufacturing steel castings by the Tropenas process. The plant is to have a capacity of 20 tons per day.

The foundry formerly conducted by the G. M. Emeny Co., known as the Fulton Foundry & Machine Works, Fulton, N. Y., has discontinued business. The equipment on hand has been purchased by the Dilts Machine Works, of the same city.

In the United States district court an order has been issued setting aside the order adjudicating the Finlay-Otten Foundry Co., Buffalo, an involuntary bankruptcy. All of the assets have been transferred to the company and settlement has been made with the creditors. The company will be at once reorganized.

The receivers in charge of the affairs of the Newton Fire Brick Co., Albany, N. Y., have been discharged and the business has reverted to the company, which has been reorganized with the following officers: W. G. Rice, president; C. B. Flint, treasurer and general manager; F. W. Kelly, secretary, and C. H. Sabin, vice president. Extensive additions to the plant are being made.

Bingham & Taylor, who operated a foundry at Buffalo for the past 20 years, have dissolved partnership. Mr. Taylor has retired and the business will be conducted under the management of William P. Taylor. The foundry was established about 50 years ago and for a time was known as the Clinton Iron Works.

The Niles-Bement-Pond Co. has leased an entire floor in the New Trinity Building at 111 Broadway, New York City, which will be occupied by their executive offices after May 1st. This company employs about 5,000 workmen, has two factories in Philadelphia, one in Hamilton, O., and one in Plainfield, N. J., and also owns the Pratt & Whitney Co., at Hartford, Conn.

It has been definitely decided that the Cast Thread Fitting & Foundry Co., of Seneca Falls, N. Y., will remain in their present location. There has been some talk of moving the works to some other city, but a committee of the citizens was appointed to hold a conference with Mr. Cutter, president of the company, and were able to offer inducements which made it an object for the company to remain.

Henry Wray & Son., Inc., of Rochester, N. Y., is a firm lately incorporated with a capital of $24,000 to carry on a general foundry business. The directors are William H. Wray, Chas. F. Wray and Cornelia F. Wray.

John Touhill, proprietor of the Riverside Foundry & Machine Co., Pittston, Pa., has purchased the property at South Scranton, Pa., formerly occupied by the Lackawanna Iron & Steel Co. The property includes six acres and several brick buildings. Mr. Touhill will take his seven sons into partnership, and a com-

pany will be incorporated to be known as the Touhill Iron Works. As soon as possible work will be started on getting the buildings in proper condition for operation as a foundry.

Means, Fulton & Co., who recently purchased the plant of the Portsmouth Foundry & Machine Works, Portsmouth, O., will dismantle it and remove the machinery to Birmingham, Ala.

The Piqua Mfg. & Foundry Co., of Piqua, O., has been organized to take over the old plant of Poorman Bros., which has been idle for some time. The new company plans to enlarge the plant and carry on a general foundry and machine business.

Edwards Bros., of Leipsic, O., has decided to take up the stock of the American Foundry Co., thus gaining full control of it. This foundry is one of the principal industries of Leipsic.

The Bessie Ferro-Silicon Co., Columbus, O., is now repairing and remodeling the Bessie furnace at New Straitsville, O., and will put on the market in the near future its well known brand of Bessie silicon iron. The company expects that the improvements now under way will, when completed, put it in a position to furnish a better quality of iron than has ever been produced at this furnace. The ferro-silicon will be from 10 to 14 percent silicon. The company expects to take orders within a month.

The Alberger Condenser Co. announce that they have opened a branch office in Chicago, in Room 316 Home Insurance Building, 205 La Salle St., which will be in charge of Mr. H. M. Montgomery.

The Cleveland & Barr Foundry Co., of Chicago, Ill., has changed its name to the Barr & Cummings Foundry Co.

Mr. P. C. Webb, of Hutchinson, Minn., has started his new foundry and reports that he has all the work that he can do.

O. S. Cross and Dr. C. W. Young have leased the Allegan Foundry & Machine Co.'s plant at Allegan, Mich., and will continue the business under the same name.

The pipe foundry of the United States Cast Iron Pipe & Foundry Co., at Superior, Wis., has been opened and has quite a large amount of work on its books. Mr. D. C. Dixon will be foreman at the plant and Mr. Frank Britts superintendent. It is hoped that the plant will have work enough to keep it busy at least until fall.

The foundry of the American Brake Shoe & Foundry Co., Bloomfield, N. J., which was closed some time ago and the business transferred to Mahwah, N. J., is to be reopened to make malleable iron castings for the company's own use.

The Perth Amboy Foundry & Machine Co., of Perth Amboy, N. J., recently incorporated with a capital of $100,000 to do a foundry and machine shop business, has secured a large tract of land and buildings, where it is installing machinery and making preparations to begin work.

The first steel was poured at the new plant of the Baldt Steel Co., New Castle, Del., April 10. It is expected that the entire plant well be in operation at an early day.

The Thole-Phillips Mfg. Co. has been incorporated with a capital of $50,000 at Florence, Ala. This company succeeds the Thole Stove Mfg. Co., whose plant was recently removed to East Florence and enlarged. The officers are Henry H. Thole, president; Thomas J. Phillips, secretary and treasurer.

The Frictionless Metal Co., Richmond, Va., will remove from that city to Chattanooga, Tenn., as soon as a foundry building can be completed in the latter city. C. E. Buek, of Birmingham, is president of the company. The plant which will be erected will be 150 x 100 ft., two stories.

The Jones-Terry Foundry & Machine Co., of Lynchburg, Va., has been incorporated with a capital of $25,000. The incorporators are: C. S. Adams, president; Chas. E. Jones, vice president and general manager; R. G. Terry, secretary and treasurer.

The Daniel Bros. Machine Co., of Tuscaloosa, Ala., which has been incorporated with a capital of $5,000, will for the present do a machine repair and blacksmith shop business, but will later add a foundry to their business.

Mr. L. C. Heminger, of Bowling Green, Ky., has sold his foundry and machine shop to Chas. Roemer. The trade does not go into effect until Jan. 1, 1906. Mr. Roemer served his time in this establishment and understands the business in every detail. When he takes possession he will remodel the plant throughout and equip it with the latest and best machinery and appliances.

Warren Heaton, of Neosho, Mo., has purchased the foundry and machine works in that city owned by J. A. Rogers. The plant was established in 1879 by Van Riper & Rogers, and in 1896 Mr. Rogers purchased the interest of Mr. Van Riper. Mr. Rogers has moved to

Joplin, Mo., where he will look after the business of the Rogers-Conklin Mfg. Co.

The Freeman Foundry & Machine Co., Joplin, Mo., is extending its business into Mexico. Several car loads of machinery have recently been shipped to Torres, Sonora, Mex. A large number of these mine cars have been shipped to Kansas, Indian Territory and Arkansas. Some new equipment is being added by the company.

The new plant of the Simmons Hardware Co., of St. Louis, Mo., is to be erected at Sioux City, Ia., and will cost at least $300,000. The contract for its erection has been awarded to Mr. Frank B. Gilbreth, of New York and Boston. Messrs. Gordon, Tracy & Swartwout, of New York City, are the architects.

Arnold & Jack, of Athena, Ore., have purchased an interest in the Zeigler & Mays' Machine Shop, of Pendleton, Ore., and will rearrange the shops at once.

The Ben F. Slack Brass Mfg. Co., of Denver, Colo., has been incorporated with $20,000 capital. The incorporators are Ben F. Slack, Frank J. Rees and W. H. Owen.

R. M. Churchman will erect a foundry and machine shop at Felsenthal, Ark.

The Walker Steel Range Co., Ltd., has removed from Windsor, Ont., to Grimsby, Ont. The company has been granted a loan of $15,000 by the city of Grimsby for a term of years and has purchased a large foundry property there, and will increase facilities in every way so that it will be able to take care of the large business which it has booked.

Smith & Wilby expect to start a foundry at Toronto, Canada, for the manufacture of steel castings. They will probably use the buildings at 340 East Front street.

The Honolulu Iron Works, Hawaiian Islands, which competed with foundries in the United States for the installation of sugar plants in Mexico and other Central and South American countries, has secured the contract to erect a 12-roller mill for the Hawaiian Sugar Co.

The Hope Metal Co., composed of Mr. Frank J. McGrail and others, has just started a new brass foundry at Kingsley avenue and Eagle street, Providence, R. I. Mr. McGrail formerly worked for the Gorham Mfg. Co.

Thomas F. Fallon & Co., of Lawrence, Mass., have just started a brass foundry at the rear of 156 South Broadway. Mr. Fallon was until recently foreman at the Frederick Byrom brass foundry.

The Innes-Demarest Stove & Heater Co., Binghamton, N. Y., has been incorporated. Capital, $200,000. The incorporators are: J. K. Innes, John Damarest, John Hull Jr., all of Binghamton.

Only the office and supply house of the Jackson Foundry & Machine Co., Paducah, Ky., were destroyed by the recent fire. The machine shop, foundry and pattern departments, across the street from the office and supply house, were not damaged at all by the fire. The company is erecting a new building near the machine shop, and in this expects to have a supply house and office.

The Niagara Foundry Co., Niagara Falls, N. Y., recently incorporated with a capital of $10,000 has taken over the plant formerly occupied by P. H. Tuohey and others, known as the Niagara Falls Foundry. There are several directors of the new company, as follows: W. E. Burleson, D. E. Nicklis, O. E. Acker, D. F. Bentley, George M. Tuttle, Harris Lumberg and W. W. Denner. The officers are: President, E. E. Nickles; vice president, W. E. Burleson; secretary, W. W. Denner; treasurer, D. F. Bentley.

The Johnstown Foundry, Machine & Car Co., Johnstown, Pa., and the plant of F. W. Leitenberger, Johnstown, Pa., have been merged into one concern under the active management of Mr. Leitenberger. The new concern will be the Johnstown Foundry Machine & Car Co., and the business of both plants will be continued as heretofore, although both plants will be overhauled and considerable new machinery will be installed. The Johnstown Foundry, Machine & Car Co. was organized some months ago to take over the plant of the Cambria Foundry & Machine Co., bankrupt. The company has made a specialty of mining cars and railroad equipment. The Leitenberger plant has done a general machinery and electrical business.

The Niles-Bement-Pond Co. report that they have purchased the property at Nicetown, Phila., Pa., formerly owned by the Cresswell & Waters Co., and will operate it in connection with their Philadelphia plants. It will be used as a foundry for their works at Twenty-first and Callowhill streets, and also for the Niles Crane Works branch.

Notice has been sent out of the dissolution of the partnership lately existing between Philip C. Smith, Harris Tabor and Howard C. Williams, doing business under the name of the Vulcan Facing Co., of Easton, Pa. The partnership was dissolved on April 10, 1905,

by mutual consent. All debts owing to the partnership are to be received by Howard C. Williams, Easton, Pa., and all demands on the said partnership are to be paid by him.

Mr. Philip C. Smith, formerly of the above company, announces that he will continue to carry on the facing business personally under the name of the Vulcan Facing Co., at Easton. Pa.

The Sterling Steel Foundry Co., Pittsburg, Pa., was not seriously inconvenienced by the recent fire in its plant. A new roof has been put on the pattern storage house, and the plant is in operation as usual.

Geo. S. Tillotson, manager of the Sterling Emery Wheel Mfg. Co., Tiffin, O., has started on a trip to Europe, and upon his return the company will erect a foundry building.

The United Foundry Co., Cincinnati, O., has been incorporated with a capital of $25,000. Incorporators are: J. W. Malloy, H. W. Mueller, Frank Grieme, George Laible and Christian Hasecoster. This company will succeed the Johannigmann Foundry Co. The business will be continued about as heretofore.

The Dayton Pneumatic Tool Co. has been incorporated in Ohio with a capital of $50,000 for the purpose of manufacturing pneumatic tools and all kinds of air appliances. It has taken over the business of the Chicago Tool & Supply Co., and will manufacture the "Green" pneumatic hammers in its factory at Dayton, O., where its principal offices will be located.

The Wauseon Foundry Co., of Wauseon, O., has its plant in operation. It will manufacture castings for the Red King wind mills, tank heaters and feed coolers. Later it expects to manufacture furnaces.

Pickands, Brown & Co., and associates, will break ground for a new blast furnace in Chicago this spring which will be modern in every particular. The location has been decided upon, but they are not prepared as yet to make it public.

The Allis-Chalmers Co. is moving its offices from Chicago to Milwaukee. On and after May 1, 1905, the general offices of the company will be located at the Reliance Works, Milwaukee, Wis. The vice president and general manager, the comptroller, assistant treasurer, office counsel, accounting and credit departments, and also the managers of the power, pumping engine, mining and crushing machinery, flour mill and saw mill departments, will all be located in Milwaukee.

The district offices of the company in Chicago, together with the electrical department (the Bullock Electric Mfg. Co.), will be removed from the New York Life building in Chicago, Ill., to the First National Bank building of that city.

The Champion Brass Works, of Coldwater, Mich., have secured the plant formerly occupied by the Knott-Van Arnum Co. The new company will be conducted by J. L. Curtis, of Gloversville, N. Y., and Casper Schwertzer, of Chicago, Ill.

The Pilling Air Engine Co., with headquarters at Detroit, Mich., has succeeded the Pilling Air Engine Works, formerly of Bucyrus, O.

The Platteville foundry, Platteville, Wis., recently purchased by C. C. Mathey, of the Galena Iron Works, Galena, Ill., was put in operation last week, with Edward Moore and Eugene Mathey as managers. A specialty will be made of mining machinery.

The Enterprise Foundry Co., of Detroit, Mich., has elected the following officers for the ensuing year: President, Frank Smith; vice president, Emil Zanwanseele; secretary and manager, Charles W. Carolian; treasurer, George S. Cuddy.

D. E. Youmans, of Midland, Mich., has purchased the business and leased the plant formerly occupied by the Cass City Foundry Co., of Cass City, Mich., and will carry on the business in future.

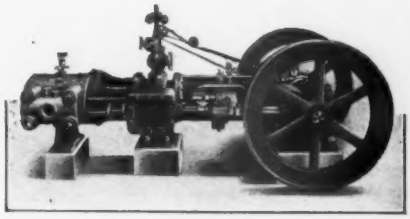
The Riverside Foundry, Newark, N. J., has been incorporated with a capital of $125,000. The incorporators are: Robert H. Ireland, Bellville, N. J.; Thomas Malcolm, of Delawanna, N. J.; J. Smylie Kinne, Jas. M. Smylie, Porter S. Kimm, Paterson, N. J.

Mortimer Griffin has purchased the interest of the stockholders in the Georgia Foundry & Machine Works, Rome, Ga., excepting the interest of Reuben Towers. Mr. Towers and Mr. Griffin are now the sole owners of the plant.

The foundry of the Edgar Skinner Iron Works, of Sumter, S. C., has just started up. They will do a general jobbing business and later on will manufacture woodworking machinery and engines.

The Arizona & Sonora Mfg. Co., of Nogales, Ariz. is planning to spend $20,000 in increasing the capacity of its works. It will install suitable new machinery, both in the machine shop and foundry. It reports that it has a large number of orders on hand and is very busy.

CLAYTON AIR COMPRESSORS



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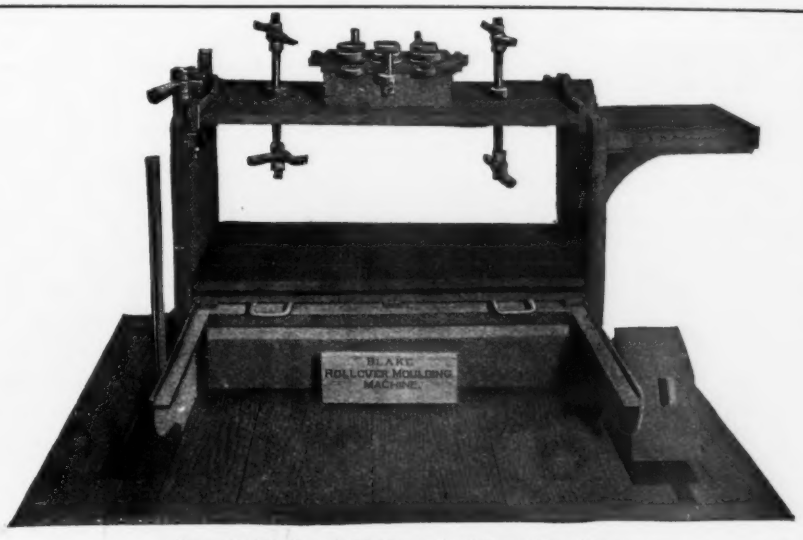
Besides their use in manufacturing, air compressors are now installed in many power houses for cleaning machines and driving repair tools.

Our straight-line frame is the most rigid made. The bearings are so far from the steam cylinders that they are not thrown out of line by radiated heat. They run smoothly and last.

If you would be up on the subject of Compressed Air and Its Uses, write for Bulletin C 201 F.

Clayton Air Compressor Works, 114 Liberty Street, NEW YORK.

169



Buy A Blake Roll-Over Molding Machine

You can use your ordinary patterns on this machine: ordinary flasks or snap flasks. The machine is simple, and easily adjusted, and particularly adapted for small work. Find out what work you have got, and write us, and we will furnish you a molding machine at a low cost that will turn your plant into a "money maker." The accompanying cut shows the Blake Roll-Over Molding Machine, complete with levers and balancing work. In operation in our own foundry, this machine produces castings with less loss than either a full pneumatic or automatic or stripping plate machine. *Write for Bulletin F.*

THE GEO. F. BLAKE MFG. CO., 114-118 Liberty St., NEW YORK. 43

Alphabetical Index to Advertisers.

Adams Co. 9, 47
Addy, Matthew, & Co. 70
Ajax Metal Co. 56
American Air Compressor Works. 69
American Blower Co. 22
Arcade Mfg. Co. 12
Atlas Car & Mfg. Co. 55
Balkwill Pattern Works 62
Barbour-Stockwell Co. 54
Barnard & Leas Mfg. Co. 60
Barnett, Oscar, Foundry Co. 21
Bartlett, N. S., & Co. 70
Battle Creek Interior Finish Co. 53
Berkshire Mfg. Co. 14
Blackwell, Geo. G., Sons & Co. 62
Blake, Geo. F., Mfg. Co. 43
Blodgett Milling Co. 61
Brass Founders' Supply Co. 64
Bristol Co. 69
Brown Specialty Machinery Co. 16
Bryan Vacuum Molding Machine Co. 64
Buckeye Milling Co. 32
Buffalo Foundry Supply Co. 6
Burdick & Son 66
*Byram & Co. 60
Canton Fillet & Mfg. Co. 57
Carborundum Co. 59
Case Mfg. Co. 63
Cherry Valley Iron Co. 29
Chicago Pneumatic Tool Co. 64
Church, S. R. 68
Clark Cast Steel Cement Co. 54
Clark, D. N. 19
Clayton Air Compressor Works. 43
Coburn Trolley Track Mfg. Co. 35
Columbus Iron & Steel Co. 70
Connersville Blower Co. ..... outside back cover
Cornell, J. B. & J. M., Co. 68
Curtis & Co. Mfg. Co. 20
Dalton, Nash & Co. 70
DeCamp Bros. & Yule Iron, Coal & Coke Co. 70
Dempwolf, E. A., & Sons. 68
Diamond Clamp & Flask Co. 69
Dimmick, J. K., & Co. 70
Dings Electro Magnetic Separator Co. 51
Dixon, Joseph, Crucible Co. 38
Domhoff & Joyce Co. 70
Elm City Engineering Co. 63
Etting, Edward J. 65
Falls Rivet & Machine Co. 15
Fanner Mfg. Co. 59
Field, Robt., Sales Agency. 71
Gautier, J. H., & Co. 36, 68
Genesee Metal Works 69
Gilmour, J. 55
Gobeille Pattern Co. 62
Goldschmidt Thermit Co. 67
Goodrich, F. A., & Co. 70
Gould & Eberhardt 65
Hanna Engineering Works 24
Herman, Chas., & Son. 40
Hill & Griffith Co. 4
Hillman, J. H., & Son. 70
Hunt, C. W., Co. 68
Ingersoll-Sergeant Drill Co. 52
Jones & Attwood 65
Keep, W. J. 61
Kendall & Flick 68
*Kent Mfg. Co. 17
Kilbourne & Jacobs Mfg. Co. 66
Lindsay, W. W., & Co. 41
Manning, Maxwell & Moore. 48
Maris Bros. 49
Maurer, Henry & Son. 68
McCormick, J. S., Co. 7
McCullough-Dalzell Crucible Co. 39
McKeefrey & Co. 70
McRath, T. S., & Co. 71
Metallurgical Laboratory 69
Middleditch, Benjamin 53
Midvale Mining & Mfg. Co. 68
Millett Core Oven Co. 27
Mills, C. E., Oil Co. 52
Mohr, J. J. 70
Monarch Engineering & Mfg. Co. 33
National Jeloluse Co. 66
New Era Mfg. Co. 67
Niles-Bement-Pond Co. 48
Northern Engineering Works. 49, 57, 63
Obermayer, S., Co. ..... inside front cover and page 1
Oregon Foundry & Machine Co. 13
Osborn Mfg. Co. 66
Otis Steel Co. 67
Partamol Co. 30
Pawling & Harnischfeger 50
Paxson, J. W., Co. 2, 3
Pedrick & Ayer 50
*Pettinos Bros. ..... —
Phosphor Bronze Smelting Co. 67
Pickands, Brown & Co. 71
Pickands, Mather & Co. 71
Pilling & Crane 71
Piqua Flour Co. 58
Pridmore, Henry E. 8
Rand Drill Co. 25
Republic Iron & Steel Co. 28
Ricketts & Banks 69
Ridgway, Craig, & Son Co. 26
Robeson Process Co. 31
Roessler & Hasslacher Chemical Co. 62
Rogers, Brown & Co. 71, 72
Roots, P. H. & F. M., Co. ..... Colored inset
Sellers, Wm., & Co. 34
Shepard, Chas. G. 71
Shuster, F. B., Co. 56
Smith, J. D., Foundry Supply Co. 5
Smooth-On Mfg. Co. 18
Standard Sand & Machine Co. 58
Sterling Oil Co. 69
Stevens, F. B. 45, 71
Stow Mfg. Co. 65
Sturtevant, B. F., Co. 23
Superior Charcoal Iron Co. 71
Sutch & Potter 64
Tabor Mfg. Co. 10
Taylor, Robert J., Inc. 37
Taylor, Wilson & Co. 11
Thomas Furnace Co. 71
Tilghman-Brookshank Sand Blast Co. 63
Walter-Wallingford & Co. 71
Walter, Wm. B., & Co. 68
Whiting Foundry Equipment Co. 42
Wilcox Mfg. Co. 51
Yale & Towne Mfg. Co. 61

Where I save money, you save it.

I once knew an old farmer who cut a hole in the barn door so the old cat could go in and out. Then he scratched his head awhile and cut a smaller hole so the kitten could go in and out. If that farmer had only had a foundry, he could have bought his facing of one man, his coke of another, and his sand of a third. Each one of these three men would have had to have a profit. The farmer-foundryman would have paid three profits where he needed to pay but one. Therefore, the wise foundryman will come to me. I sell everything he needs, and the profit he pays me is enough. I reach him with one traveler. I need only one set of books to look after his purchases. I have only one office and I centralize everything—even the profit. I dispense with profits that other dealers need in their business. In other words the kitten can go in and out the same hole as the old cat.

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Roots Second-hand Blowers, bought, sold or exchanged for new ones. Address,
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RATTLERS.—Four Brown & Sharpe Manufacturing Co. No. 3 Foundry Rattlers for sale at low price, now running. Address for particulars, Box 421, THE FOUNDRY, Cleveland, O.

FOR SALE CHEAP.—One 7½ Baker Rotary pressure blower, good as new, 24 inch outlet. For particulars address "C. F. R.," Box 422, THE FOUNDRY, Cleveland, O.

FOR SALE.—Iron manufacturing plant with cupola, blower, boiler, engine and shafting. Indiana town 100 miles from Chicago. Will sell at bargain. Address Box 429, THE FOUNDRY, Cleveland, O.

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FOR SALE.—Two 10 ton Craig Ridgway & Son Steam Hydraulic Cranes; one 3 ton Craig Ridgway & Son Steam Hydraulic Crane; one 6 ton Farrel Foundry and Machine Co. Power crane; two 2,000 lbs. Brown Hoisting Machinery Co. Cranes; one 6,000 lbs. Yale & Towne Mfg. Co. Crane; nine 3,000 lb. Yale & Towne Mfg. Co. Cranes; one 2,000 lb. Yale & Towne Mfg. Co. Crane. Nearly all sizes solid and split cast iron pulleys from 10 inches to 8 feet 6 inches diameter. Nearly all sizes shafting and hangers. For further particulars and sketches inquire CHAPMAN VALVE MANUFACTURING CO, Indian Orchard, Mass.

FOR SALE.—Two No. 16 Colliau Cupolas, built by the Byram Co., Detroit, Mich. Description: Total height of air box, 50½ inches; diameter outside air box, 76½ inches; diameter outside of shell, 54½ inches; diameter inside after lining, 40 inches to 45 inches; capacity in tons of iron melted per hour, 5 to 7; height over all, 40 feet. For further information, prices, etc., address STUDEBAKER BROS. MFG. CO., South Bend, Ind.

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WANTED.—Foreman for brass foundry doing general jobbing business, light and heavy casting. Must be thoroughly competent and first-class. Address Box 427, THE FOUNDRY, Cleveland, O.

WANTED.—Foreman to take charge of jobbing foundry, melting about 25 tons daily; must be good iron mixer and experienced with molding machines. Address Box 424, THE FOUNDRY, Cleveland, O.

WANTED.—Foreman for small foundry. One who thoroughly understands manufacture of mine car wheels and locomotive castings. Must be thoroughly skilled in compounding iron for light and heavy castings. No union man need apply. Address, B. H. BIAYS, Cumberland, Md.

WANTED.—Foreman to take charge of foundry now under construction. Will pour twenty tons daily. Wide range of work, including gears, machinery castings and general work. Must be familiar with machine molding. Address, with full particulars, Box 391, care THE FOUNDRY, CLEVELAND, O.

WANTED.—Foundry foreman who thoroughly understands making of steel castings. Must have not less than $2,000.00. Exceptionally good opportunity for a capable man. References. Address "STEEL CASTING," Box 428, THE FOUNDRY, Cleveland, O.

WANTED.—Foreman Molder for Stove Foundry employing about 125 molders. At present running under union rules. Must be thoroughly experienced, first-class handler of men and well up in cupola practice. Address, with references and salary expected, Box 420, THE FOUNDRY, Cleveland, O.

WANTED.—A first-class all around molder, who is familiar with up-to-date practice, having had experience with molding machines, handling workmen, and who is competent to act as foreman in agricultural foundry in a large Western city. Give age, experience, references and wages expected. Address Box 431, THE FOUNDRY, Cleveland, O.

WANTED.—In Brooklyn, N. Y., as foreman, first-class man in old established foundry, making light grey iron castings; also some brass and bronze metal castings. 125 molders. Floor and bench work. Some molding machines used. Life position. Good salary. Address THOS. HICKEY, 83 North Tenth Street, Brooklyn, N. Y.

WANTED.—A superintendent for a malleable plant situated in the best malleable district in the country. He will have complete charge of plant, free rein in handling of men and every opportunity to produce results. The plant has a capacity of about 50 tons per day and business constantly growing. None but those actively engaged in the business and capable of giving the best of reference, will be considered. All correspondence strictly confidential. Address Box 434, THE FOUNDRY, CLEVELAND, O.

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WANTED.—Position, by radiator and boiler coremaker. Six years' experience. Address Box 423, THE FOUNDRY, Cleveland, O.

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Wanted.

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are of malleable iron. The snaps are without doubt the quickest snaps to operate.

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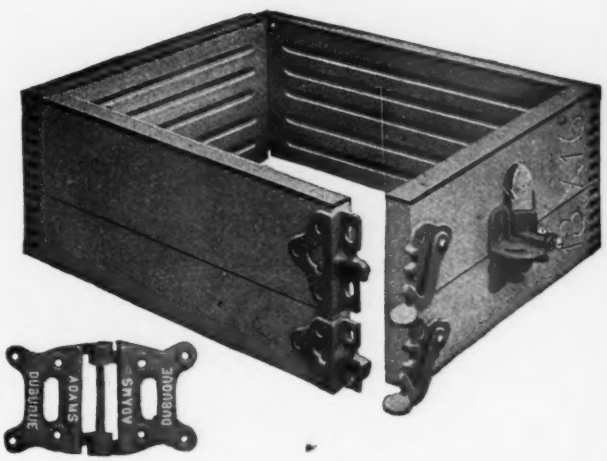
of malleable iron, with ¾ inch milled bearing on each side of the right angle. Fine adjustment in both ears is provided by means of a screw on the ends of the ears. Both ears being adjustable, cope and drag are easily kept in line.



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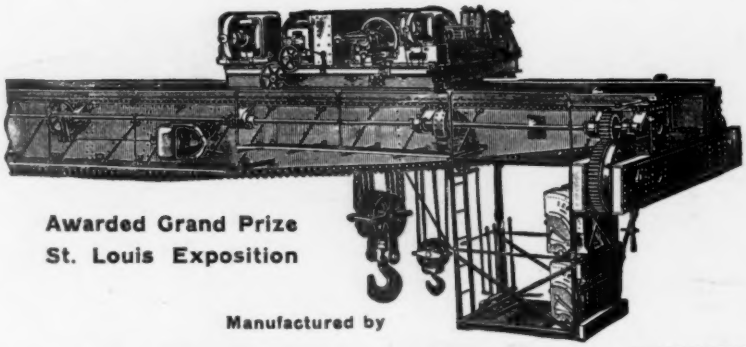

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Manufactured by

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It is used in the **Machine Shop**, the **Power House**, the **Foundry**, the **Steam Plant.**
It has few parts and is therefore simple and accessible.
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